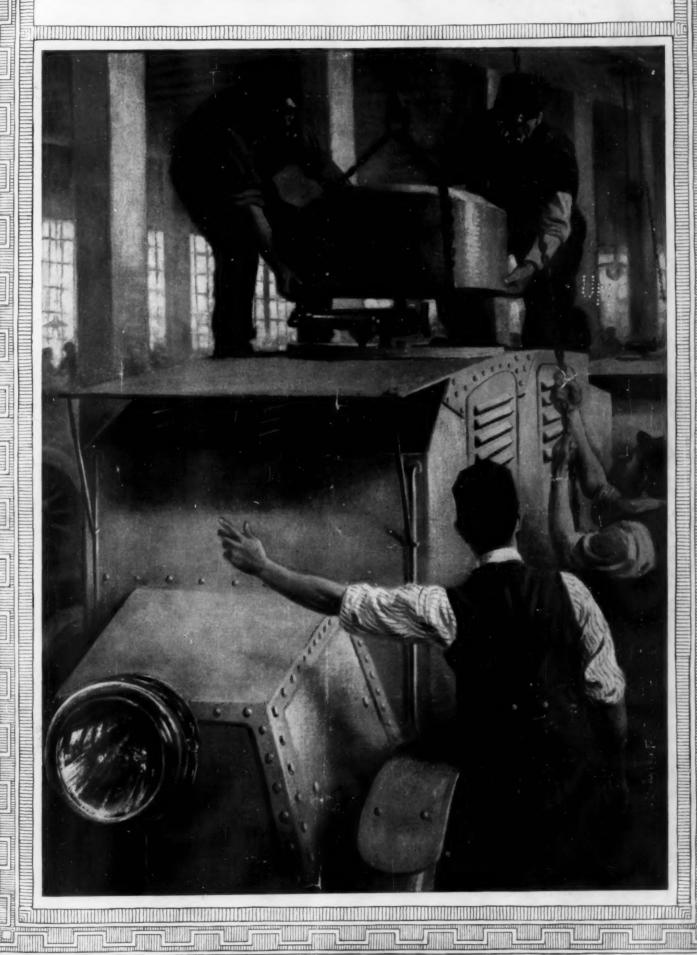
SCIENTIFICAMERICAN





The distinguishing characteristic of a masterpiece is harmonious perfection

Every line in the marble, every color in the picture, every thought in the book, belongs to and blends into the complete creation.

An analysis of White Motor Cars—line by line and feature by feature will bring out many thoughts, each one of which will seem to be paramount.

The complete elimination of the conventional back of the front seat—always awkward in appearance—through the accomplishment of the finally-perfect stream-line body, may impress many people as an unusually important thing.

And it is. Yet, in viewing The White, the eye is led naturally and easily along until at last the mind holds, as in the beginning, the picture of the complete car.

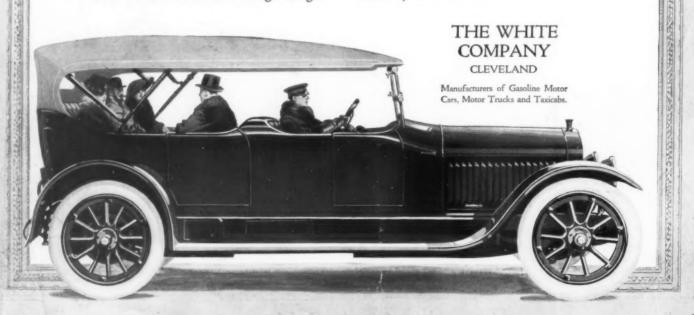
White leadership is a principle

Many mechanical features that are "new" today were perfected and presented in The White long ago. 1909 saw The White with the first mono-bloc, long-stroke, high-speed motor—the very type which now is heralded as a sensation.

In 1910 The White presented the logical leftside drive with center control, and in 1911 The White introduced electrical starting and lighting with the tremendous advantage of a non-stallable engine.

From time to time other important improvements have been brought out, and today Theo White holds a position peculiar to itself in that mechanical excellence has been matched with external beauty.

The latest White Motor Cars are now exhibited by all White dealers.





This is America's big tourist year. The nation comes into its own as the sightseer's paradise. From Florida to California—from the lakes to the gulf—in the west and in the south, will be found—newly discovered—an American Tyrol—an American Riviera—a new Naples, and "Switzerlands"—beauty spots without number.

Take your pleasure on Goodrich Safety Treads. Make the short tour or the long journey safe, sure and profitable with these great big, service-performing

Goodrich Safety Tires

which are the winter resort favorites at Palm Beach, at Santa Barbara, at San Antonio, at the resorts throughout the length of the land.

Goodrich Safety Treads are found on the cars of those who know quality and service at first hand.

Goodrich Tires are the world's standard in built-in serviceability and price.

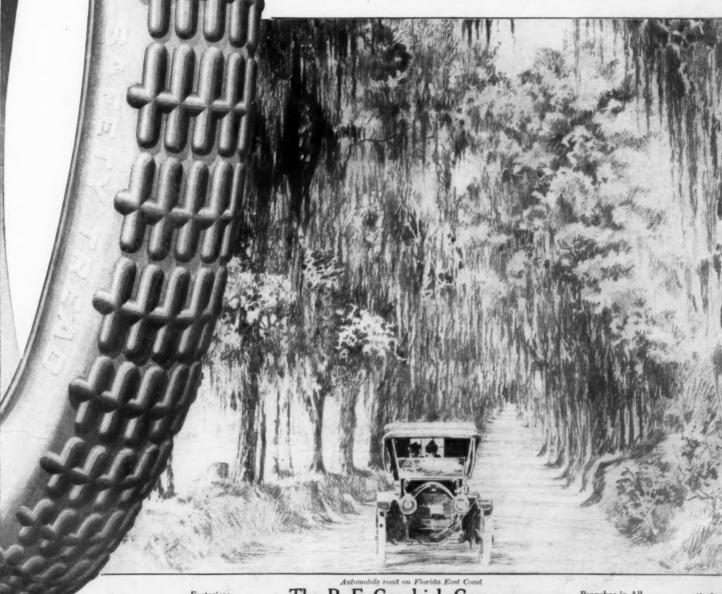
Tire history has been made by Goodrich.

The unit molding, the rubber compounding, the tread density, the "Safety First" design, and the positive tractive and non-skid results, belong to Goodrich and to none other.

These qualities are exclusive and can not be duplicated in other tires.

No other tires in the world today, are backed by a rubber experience of nearly half a century. No tires can show better service records.

In price, Goodrich is the standard, as in everything else, and year in and year out Goodrich gives you the best tire at the best price, with long mileage, comfort and safety thrown in for good measure.



The B. F. Goodrich Company

There is nothing in Goodrich Advertising that ign't in Goodrich Good

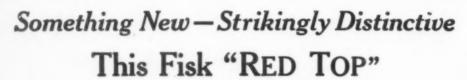
Branches in All











Made in Many Sizes and All Types

FOR the first time in the history of tire making appearance has been given its rightful share of attention. The result is the Fisk "Red Top"—the wonderfully attractive tire with the white sidewall and pleasing red non-skid tread—which adds the note of completeness to the finely appointed limousine or lends distinction to the most modest car.

The Fisk "Red Top" is an exclusive product—entirely different in design from any other. It is the stamp of quality in tire equipment.

The "Red Top" is as good as it looks. Its attractiveness, strong traction tread and returns of extra mileage make this tire most desirable from every point of view.

Ask your dealer for the new Fisk "Red Top" with the attractive red non-skid tread and the white sidewall.

THE FISK RUBBER COMPANY

Factory and Home Office

Chicopee Falls, Mass.

Fisk Branches in 46 Principal Cities





Finality in Tire Equipment



All argument ends with your first ride in

The Eight-Cylinder Cadillac

The new Cadillac with its V-type Eight-Cylinder Engine is proving an absorbing topic for engineers and experts as well as for the layman.

Technical arguments, vague and beclouded, can of course be advanced for and against any and every type of engine ever produced.

But theoretical speculations in this instance are very short-lived.

There is slight encouragement to argue the pros and cons of a principle when that principle, in the first performance, removes the last, lingering doubt.

That is exactly what occurs in the case of everyone who rides in the Eight-Cylinder Cadillac.

All arguments end with the first ride—whether the observer be an engineer or a layman.

The man who rides in the Cadillac for the first time does not need to be told by a technical expert that its eight-cylinder engine is an impressive success.

He knows without being told.

There is no need to consult blueprints or text books.

He has only to consult his own feelings and sensations.

He recognizes the difference just as clearly as he would recognize the difference, for instance, between riding over the ground and riding in the air.

And compared with previous motor car experiences, riding in the Cadillac is very much like riding in the air.

It is not necessary to point out to him that the Cadillac Eight-Cylinder engine exhibits a new degree of flexibility.

That is perfectly apparent even to an amateur in motoring, in the extraordinary ease of acceleration and the astonishing extent to which the Cadillac travels without gear shifting.

He does not need to be told that the car is surpassingly smooth.

He *feels* it—precisely as he feels that hills seem to flatten out before this wonderful car.

The engineer can explain to the layman the why and the wherefore of these differences; but the layman can feel just as keenly as can the engineer, that a ride in this car is not like any ride either of them has ever taken.

It is the business of the scientific mind to withhold judgment until a principle has been proven.

But Cadillac owners have a pleasant habit of expressing complete confidence in Cadillac promises.

They are chiefly concerned to know **how much** and **how far** the Eight-Cylinder Cadillac will surpass all that has been said of it in our announcements.

And they have demonstrated the faith that is in them by placing advance orders to an extent which far surpasses all previous records.

That fine spirit of expectation will not be disappointed.

We repeat—for expert and layman, all theorizing will end with the first ride in the Eight-Cylinder Cadillac.

STYLES AND PRICES

Standard Seven passenger car, Five passenger car and Five passenger Salon, \$1975. Roadster, \$1975

Landaulet Coupe, \$2500. Five passenger Sedan, \$2800. Seven passenger

Limousine, \$3450. Prices F. O. B. Detroit,

Cadillac Motor Car Co. Detroit, Mich.

Doos Brothers MOTOR CAR

You are almost sure to ask yourself how it is possible to incorporate such quality at so moderate a price

The price of the car complete is \$785 f. o. b. Detroit

DODGE BROTHERS, DETROIT



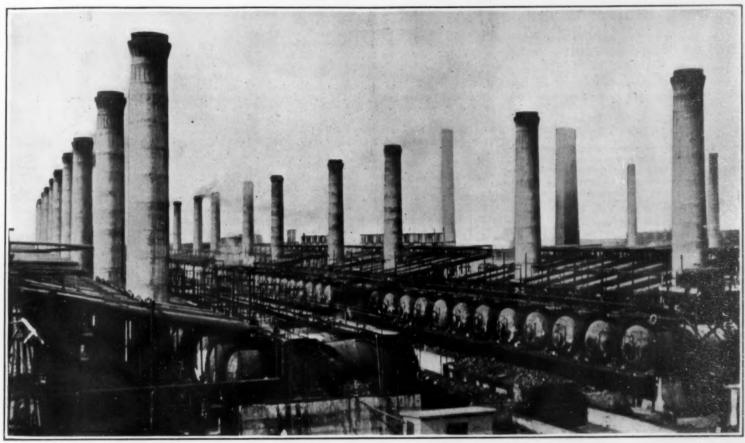
SCENTRICAMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIL

NEW YORK, JANUARY 2, 1915

15 CENTS A COPY



Plant for producing gasoline by the Burton process of distillation under pressure.

The Burton Process of "Cracking" to Make Gasoline

By C. H. Claudy

G ASOLINE, not long ago a by-product of petroleum refining, has come to be one of the most important results of crude oil distillation. The rise of the internal combustion engine, and its rapid perfecting, due to the enormous increase in the manufacture of the automobile, has not only created a tremendous demand for gasoline for the motorcar, but has spread the doctrine of cheap and easily secured power throughout the world, so that motorboats, aeroplanes, farm engines, and other light motor apparatus use probably in the aggregate as much, if not more, gasoline than do the automobiles.

In this country there are at least 1,000,000 automobiles in use. Production of automobiles is an unknown quantity, since the manufacturing census, taken every five years, is not yet available for 1914, and the 1909 census throws no light on present-day conditions. But with one single factory announcing its hope of completing 300,000 machines in one year, and several others stating that they will produce from 25,000 to 50,000 machines in a year, it would surprise no one that in 1915 half a million machines were added to those already rolling on our 1,200,000 miles of roads.

The demand for gasoline has thus surpassed that for kerosene, once the main product of crude oil refining, to such an extent that were it not for the education of many foreign peoples to the advantages of the use of kerosene its production would have to be curtailed, which in itself would curtail the production of gasoline and thus raise its price.

In the early days of crude oil refining the various hydrocarbons were separated from crude petroleum and from each other entirely by the process of fractional distillation, the lower heats driving off the gases and then the liquids of lowest specific gravities and boiling points, the first rise in temperature separating the liquid of next highest specific gravity and boiling point, and so on, until all the usable gases and liquids had been distilled, leaving a residue which represented loss.

The process can be expressed in a homely manner by comparing crude petroleum to a pile of stones of all sizes—immense boulders representing the heaviest oils, smaller ones the lighter oils, cobblestones the liquids which we know as the naphthas, benzines and gasolines, and pebbles the gases. The process of fractional distillation is a mere sorting of these various stones into different piles, each pile of which contains substantially only stones of the same size, weight, and composition.

Such a process, however, does not yield enough cobblestones for the present-day market. The yield of gasoline through simple distillation of crude petroleum will vary, of course, with the character and composition of crude petroleum used. An analysis of crude shale oil, which may be considered a fair average, shows gasoline and naphtha to be not quite 7 per cent of the total, the burning oils not quite 32 per cent, heavy oils and paraffine scale about 39 per cent, and the rest loss.

It is obvious that if every barrel of forty-two gallons crude oil yielded less than four gallons of gasoline, the United States could hardly export 183,000,000 gallons of "motor spirit" in 1913, in addition to her own enormous consumption, even with a crude oil production of 9,328,755,156 gallons of petroleum for the year.

So recourse is had to a process known as "cracking," a highly illustrative name for destructive distillation. Reverting for a moment to the several piles of stones, it will be readily understood that the man who wanted a lot of cobblestones and did not find enough in his miscellaneous pile would probably invest in a few hammers and proceed to crack some of his larger boulders into appropriate sizes.

It has been known for a long time that when petroleum is subjected to high temperatures, but without pressure, the hydrocarbons contained in it can be broken up or "cracked." Most of the hydrocarbons contained in petroleum belong to the so-called paraffine group, of which the general formula is C_nH_{,n,n}. When these paraffine hydrocarbons are decomposed it is the general rule that the resulting hydrocarbons consist in part of members of the ethylene or other unsaturated series. Just what does take place in this connection is not known, but we do know that the specific gravities

and boiling points of the resulting hydrocarbons after such "cracking" has taken place are, in the main, lower than existed in the original material.

than existed in the original material.

In the Burton process of "cracking" to produce gasoline, now in use by the Standard Oil Company, and for which a \$700,000 plant has been erected at Whiting, Ind., this difficulty is overcome. Strangely enough, the inventor of the process can offer no satisfactory explanation of why it is successful where other and not greatly dissimilar processes fail. In dealing with chemical operations in manufacturing industries, it is often possible to get a result, and to know the exact means by which that result is attained, without knowing the reason underlying the process. Exactly the same thing occurs when we turn an electric current into a motor and produce power. We know how to do it and the means we must employ, but why an electric current produces magnetism and why magnetism acts as it does we know no more than the most fignorant swage.

The Burton process employs a container or still, provided with a proper fire box, a safety valve, a pressure gage, a temperature gage, etc., from which a pipe rises on an upward slant, which pipe is later curied into a coil contained in a tank where it is cooled with water. This pipe further leads to a reservoir, where the products of distillation collect. Beyond the condensing coil and just previous to its entry into the collecting tank is a valve. At the lower end of the coil in the condenser is a vent pipe, also provided with a valve.

The reader unfamiliar with this apparatus will see at first glance little to differentiate it from any apparatus for destructive distillation under pressure. The great difference comes in the point at which the valve is placed. In previous apparatus the valve was placed between the still and the condenser. By leaving such a valve closed while heat was applied, pressure could be put upon the liquids in the still, thus raising their boiling points and accomplishing a form of "cracking." For no reason which can be understood, such methods, however, when applied to fuel oil of the paraffine group formula, resulted mainly in gasolines of the objectionable ethylene group, with the general formula C_0H_{gas} .

(Constuded on page 88)

SCIENTIFIC AMERICAN

SCIENTIFIC AMERICAN

NEW YORK, SATURDAY, JANUARY 2, 1915

Published by Munn & Co., Incorporated. Charles Allen Munn. President; Frederick Converse Beach, Secretary Orson D. Munn. Treasurer all at 361 Broadway, New York

Entered at the Post Office of New York, N. V., as Second Class Matter Entered as Second Class Matter at the Post Office Department,

Canada.
Trade Mark Registered in the United States Patent Office
Copyright 1915 by Munn & Co., Inc.
Illustrated articles must not be reproduced without special

Subscription Rates	*
Subscription one year	\$5.00
Postage prepaid in United States and possessions. Mexico, Cuba, and Panama	
Subscriptions for Foreign Countries, one year, postage prepaid, Subscriptions for Canada, one year, postage prepaid	4.50 5.75
The Scientific American Publications	
Scientific American (established 1845)per year.	\$3.00

The combined subscription rates and rates to foreign co-cluding Canada, will be furnished upon application Remit by postal or express

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Review of the Year 1914 Army and Navy.

NY review of naval and military affairs must sarily take account of the lessons which ave been taught by the great World War Limitations of space prevent any review here of the events of the war; that must be left to be dealt with in detail in a later issue. It is sufficient in the present review to draw attention to the fact that from the opening days of the conflict to the present hour the theories on which modern armies and navies, with their elaborate and complicated matericl, have been built up have been vindicated to a degree and with an exactness which is really wonderful. As regards war on the sea. it has been demonstrated that battleships are the back bone of any navy, that upon these all the other units depend, and to the battleship's efficiency they all min-Proof of this is seen in the fact that it is the preponderance of the British battleship line which for nearly half a year has been holding the main German fleet inactive within the shelter of its own barbors all the engagements which have taken place between the minor units-cruisers, destroyers, etc.-victory has always lain with the fleet which possessed the heavier artillery and the speed to enable that artillery to be used at most advantageous range. That much-debated type, the battle-cruiser, so far as it has had opportunity, has abundantly vindicated itself, a notable case in point being the destruction of Admiral von Spee's soundron in the South Atlantic. The scout-cruiser of high speed has proved its value on all the seven seas: as witness the wonderfully successful commerce-destroying work of the German scout-cruisers "Emden," ruhe" and their sisters, and the exploits of the British "Undaunted" and "Arethusa," designed as destroyers of destroyers, which, in the case of the "Undaunted," one morning four German destroyers in a running ght. No less effective, as a type, has been the large, reli-armed and swift destroyer. To these vessels has fallen, very largely, the difficult and dangerous work of maintaining a close blockade of the German ports. On only two occasions have the Germans broken through for a raid along the coast of England. The destroyer flotillas have been the object of ceaseless attack by s marines, several of which they have sunk by ramming. is noteworthy that by keeping a sharp lookout and by dexterous use of high speed and the helm the destroyers have usually been able to detect and avoid the torpedoes of the enemy. The early losses of the British ubmarine attack proved that it was impossible for the larger cruisers to maintain a close patrol of the my's shores. It is probable that ships of the size of the "Cressy" have been withdrawn farther off shore, and that to the swift destroyers has been allotted the work of forming the inner lines of blockade. The submarine done exactly what the naval experts believed it would do, by forcing the larger and more valuable ships enemy to remain far from the home coast Nowhere has the German officer proved his effiso thoroughly as in the submarine service. Such good work has he done with the coast-defense submarines of moderate size that the advent, at an early date. of the sea-going submarine of large size and battleship speed is a certainty.

As regards the war on land, unquestionably the m impressive fact is the controlling influence which has

been exerted upon the strategy and tactics of war by Aerial scouting has robbed military strategy of that element of secrecy upon which it was Particularly has this been evident in the operations in France and Belgium, where, owing largely to the foreknowledge by each Commander-in-Chief of the projected attacks of the enemy, it has been possible to maintain a balance of forces on all parts of the battle line, which has brought about conditions approaching those of a stalemate. The wide turning movement, the surprise attack in overwhelming force, splitting the enemy in two and defeating him in detail, and many of the other decisive maneuvers which carried Napoleon like a thunderbolt through Europe, are gone never to return. Field artillery has added to its reputation as the controlling element, other things being equal, in modern battle; and the stream of machine-gun bullets has established itself as a means of attack and defense, second only in deadly efficiency to shrapnel fire. In fact, it is shrapped and the machine gun which have been doing the wholesale slaughter of the present war.

One of the great surprises of the war was the size of the German slege against whose fire the Belgian and French forts proved to be utterly helpless. The most efficient weapon is the 11-inch howitzer, which, it now appears, has done most to be utterly helple The most efficient weapon is the of the work of fort reduction. The gun has attained the same mastery of the fort as the naval gun has of armorplate on the battleship. More than ever it has been proved that the mobile field army, thoroughly equipped with field artillery, howitzers, aeroplanes and transport, is the main reliance of the land forces of a nation, either for attack or defense

Civil Engineering.

So surpassing has been the public interest in the war that great events in the broad field of science and the arts have transpired with but a passing notice. spicuous among these has been the opening of the Pan ama Canal to the world's shipping. In spite of the great Cucuracha slide, the new and powerful dredging plant has opened and maintained a channel sufficient for the age of ocean ships of large size. The growth of traffic has been steady and very encouraging, particularly in the trade between Atlantic and Pacific ports of the United States. Except for the slides of Culebra. which were expected and can be controlled, this great work has functioned admirably; and it stands to-day as noble tribute to American engineering and executive bility. The formal opening will take place early in the ability.

spring of this year. Rivaling the Panama Canal opening in importance was the completion of the enlargement of the Kiel Canal, which took place last summer. The normal width of the canal is now 335 feet on the surface and its depth The twin locks at each end are 1,092.6 feet in usable length and 147.6 feet in width, as against a length of 1,000 feet and a width of 110 feet of the locks at Panama. The work of reconstructing the canal cost \$55,000,000. Its strategic value in the present war simply inestimable. Another ental of great importance maritime commerce is that at Cape Cod, shortens the distance between Vineyard Sound and Boston by about seventy miles, and enables vessels to avoid the exposed and stormy waters of Nantucket Sound and Cod. Work has progressed steadily on the enlarge ment of the New York State Barge Canal, extending from the Great Lakes to the Hudson River, whose total cost, with the fifty terminals to be constructed along will be about \$128,000,000. branches, the canal system totals about 790 miles of navigable waterways; 440 miles of this has been con structed and the remaining 350 miles lies through canalized streams. Work has progressed satisfactorily Work has progressed satisfactorily on the great Catskill water supply which will bring 500,000,000 gallons of mountain water into New York per day through an aqueduct ninety miles in length. and distribute it through a 12-foot tunnel built eral hundred feet below the surface of Manhattan Island. The great Ashokan dam in the Catskills and the aqueduct leading into the city are practically com and water may now be brought Catskills to augment the supply in the Croton Reservoir. An important work nearing completion is the great lock of the Government canal at Salmon Bay, by which shipping will pass from Puget Sound at Se eattle to Lake Washington and Union. The lock is 825 feet long, 80 feet wide, and 56 feet high. A vast national work of reclamation which has been the object of much favorable attention by the people of the Netherlands is that for filling in the greater portion of the Zuyder Zee. The me contemplates building an enbankment 31,000 yards in length across the mouth of the Zuyder Zee and reclaiming 529,605 acres of land. The rentals from this land are estimated at \$6,000,000 a year and the value of the probable crops \$28,000,000. An important development in New York is the construction of a series of 1,000-foot docks to accommodate the large ships of the present day. The much-talked-of bridge (highway and railroad) across the North Hiver has yet to be built; but during the year there was presented a

most reasonable proposition and one that will probably be followed, namely, to have the bridge built by private capital and leased to the railroads and the States of New York and New Jersey, one half the rental to be assumed by the railroads and one half by the two The proposed bridge is to have two decks, one or highway traffic, the other for eight railroad tracks The North River Bridge would have a central span of 3,000 feet, with main towers each about 600 feet in height. The Quebec Bridge, with a central span of 1,800 feet, the largest cantilever structure in the world, is making good progress. The piers are completed and the erection of the superstructure is under way other monumental bridge which has been greatly adanced during the year is the great 1,000-foot span, arch bridge, connecting the New Haven and Pennsylvania railroads, which is being built across the East River at Hell Gate. A vast engineering problem, work upon which has been pushed steadily through the year, is the control of the Mississippi River. There is a grov ing conviction that the method of embankment and revetment adopted by the army engineers is the only possible way to solve the problem, and earnest efforts being made to induce Congress to appropriate suffi cient money to enable this work to be pushed to completion with all the men and mechanical appliances that can be crowded upon the work.

Merchant Marine.

The most important event of the year in connection with the merchant marine was the signing of the seventy-four articles of the Convention of the International Conference on Safety of Life at Sea, which met at close of last year in London. The most important find-ings are those affecting construction of ships; and on this point the Convention provided that the degree of shall increase in a regular and continuous ner with the length of vessels, and that vessels shall be empletely subdivided as possible, having regard to the services for which they are intended. Although the work of the Conference did not go as far as we could have wished, the ratification of the Convention by the various maritime nations will mark a great step in the direction of providing safer travel on the high seas. Unfortunately, Congress is still debating the question of ratification; and it seems likely that the safety of the general public is to be sacrificed to the convenience of the seamen. The importance of this matter was emphasized during the year by the sinking of the "Empress which went down in twenty minutes after of Ireland, collision, with the loss of about 1,000 souls. Further emphasis was laid upon the question by the burning of the "Volturno," in which it was proved that the orditype of lifeboat is practically useless when disabled ship is rolling heavily in a seaway. Two more of the vast 900-foot passenger steamers have gone commission during the year, the "Vaterland" and the The former, built by Blohm & Voss for the Hamburg-American Line, is 950 feet in length, 100 feet in beam, and displaces 58,000 tons. The "Aquitania." built on the Clyde for the Cunard Line, is 901 et long, 97 feet broad, 92 feet deep to the boat deck and has a displacement of 53,000 tons on a draft of 36 feet. There was launched during the year by Blohm & Voss a sister ship to the "Vaterland," the "Bismarck"; and at Belfast there is nearing completion for the White Star Line the "Britannic," a somewhat enlarged "Olympic," which embodies in her hull construc-tion all the recommendations of the London Convention is regards safety subdivision. The steam turbine continues to demonstrate its superiority as a drive for large, fast ships, and the success of the various types of transformers indicates that ultimately a combination of turbine and transformers, and to a less extent of oil engines and transformers, will become general. mechanical drive of Westinghouse, the hydraulic reduc-tion gear of Foettinger, and the electric reduction gear as used on our collier "Jupiter" have all shown excel-Certainly the most remarkable development in this direction has been the decision of our navy to install electrical reduction gear on tleship, the 32,000-ton "California." This action was taken as the result of the excellent results obtained on the collier "Jupiter." The merchant marine of world continues to show marvelous growth, Great Britain leading with a tonnage nearly one third greater than that of all the other maritime powers combined. The totals are: Great Britain, 20,275,791 tons; Germany, 4,998,746 tons; United States, 3,489,736 tons, chiefly domestic shipping; Norway, 2,475,323 tons; rance, 2,246,504 tons; Japan, 1,700,062 tons, and Italy, 1.571,761 tons.

The Steam Railroads.

The most interesting development among the steam railroads is that occurring in the motive power. Al-though the electrification of the New Haven Railroad has been completed as far as New Haven and the electrical service is in successful operation, and although, particularly in the mountain districts, some important changes from steam to electric power are taking place, there is as yet no indication of that general

substitution which used to be predicted a few years ago. Undoubtedly electrification has been postponed many years, at least, by the recent remarkable develop-ments in superheating. It has been found that the use large cylinders, moderate pressures, and superheat produces an improvement in the efficiency of the simple ocomotive which is truly remarkable, amounting to 25 and in cases even 30 per cent. The promises held out when compounding was introduced, and never fully realized, have been more than realized in the introduc The locomotive continues to grow in tion of superheat. size, as witness the appearance of the large pusher freight locomotive built by the Baldwin Works for regar localities and by the heavy grades of the Eric Railway.
The engine is a Mallet compound; but its weight and power have been increased by adding a third pair of cylinders and a set of six-coupled driving wheels car ried by the frame of the tender. The boiler has 6,886 square feet of heating surface, and the steam is utilized in one pair of high pressure and two pairs of low pressure cylinders. The diameter of all cylinders is 36 inches and the stroke 32. The working pressure is 210 nucles and the stroke 32. The working pressure is 210 pounds and the drawbar pull 80 tons. The total weight of this huge engine is 477½ tons, of which 376½ tons are upon the drivers. The general movement in the direction of safer travel received impetus this year the introduction of the new Westingh through brake with electric control. A twelve-car steel train. 1,000 tons in weight, running 60 miles an hour, was stopped within its own length of 1,000 feet. The maximum brake capacity was obtained in 3½ seconds as against 8 seconds. A twelve-car train running 80 miles an hour can be stopped within 2,000 feet. That railway travel may be made perfectly safe, even where is heavily congested, is shown by the experience of the New York Subway, which during the year pointed with great pride to the fact that its lines have carried 2,198,000,000 persons in the last nine years without a single passenger fatality, and this in spite of the fact that the speed and frequency of this train service are unsurpassed anywhere.

Electricity.

Undoubtedly the most important scientific event of the year was the discovery by Prof. Kammerlingh Onnes that when certain metals are cooled to a tem perature pear absolute zero they cease to have any measurable electrical resistance and a current started in a coil thus cooled will continue indefinitely, without any appreciable diminution. Whether this discovery will ever have any commercial application in the field of electrical engineering it is impossible to say. present it seems unlikely, and yet all our electrical machinery of the present time had its beginning in experiments that seemed just as impracticable, from a commercial point of view, as this one: Turning to the prac-tical side of electricity, the present war shows how indispensable this form of energy has become. We find it used in the telephone and telegraph, both by wire and through the ether; it is used at night to throw powerful beams of light; in the hospitals to locate bullets; in camp for sterilizing water. In this connection we might refer to the new United States Army portable wireless station, consisting of a motor vehicle equipped with a powerful apparatus that has transmitted me sages a distance of 800 miles under favorable condi-tions. Wireless telegraphy has been successfully used to send messages from aircraft. With a small apparatus weighing altogether 15 pounds, the British government has been able to transmit communication from an aeroplane over a distance of twenty miles. Turning to peaceful pursuits, wireless telegraphy has been used by the Fire Department of New York to keep fireboats in touch with headquarters and also with incoming boats that are afire. The success of this system points to the possibility of providing a deep-sea fireboat service. fore the war wireless weather service was established in the North and Baltic seas under German auspices. Significant of the intense interest in wireless telegraphy displayed by amateurs is the league, recently formed. establishing relay stations all over the country, so that messages may be relayed from Maine to California. less telephony has shown progress this year. Messages were exchanged between Berlin and Vienna, a distance of three hundred miles. A portable wireless receiving outfit mounted on an automobile received spoken me sages from the Eiffel Tower at a distance of sixty miles. There has been marked electrical development in the field of motor vehicles, particularly in the introduction of electrical devices on gasoline motor vehicles. To encourage touring, road guides have been distributed among electric vehicle owners in certain parts of the country, with directories of electric garages where batteries may be recharged. In Vienna, after a fifteen-month test, fortyfive electric mail trucks were purchased, each of two and one half tons capacity, and with a range of twentytwo miles. An electric tractor used by the Pennsylvania Railroad for moving freight cars through streets showed, in seven months, a saving of nearly 50 per cent of the cost of operation had horses been used. There

e progress in the electrification of railroads The New York, New Haven & Hart ford system has extended its electrified zone from Stam ford as far as New Haven. In Norway the governmen is converting its steam railroads into electric lines. Work has already begun on the Christiania-Drammen road, and the government is buying up as many falls as possible to provide sufficient current for the entire railroad system of the country. Of local interest is the hydro-electric plant at Washington, D. C., Congress. By damming the Potomac 99,000 horse-power will be available. There have been many novel and curious uses for electricity during the year. In Argentine a method has been devised of electrocuting gra hoppers and their eggs. A portable plant capable of developing a tension of 6,000 volts energizes a wire screen which is placed over the ground to be treated, and by this means the insects are destroyed. Trees are similarly treated with metallic brooms having insulated handles. Some advance has been made in electrocul-ture. One experimenter has shown that repeated applications of Roentgen rays for periods of one hundred and fifty seconds have a marked stimulating effect upon the growth of the plant. In one of our western towns a high school has been equipped completely with electrical apparatus and even with electric heating apparatus. No furnace man is required. We might continue ad infinitum to list the various novel uses of electricity that the year has brought forth, but the few instances cited will suffice to impress one with the con tinued growth and endless development of this branch of practical science.

Although no striking innovations in aeroplane con-struction have been brought forward during the past year, nevertheless that important advances have been made in the science of aviation is evidenced by the more perfect control that is apparent, and the increased reliability and endurance of the later models. The general results of improvement are marked, and are due to refinements of details, largely the result continued scientific study of the underlying principles and the experiments conducted in the laboratories that have been established for the purpose. One direction in which these studies have made themselves evident is in the increased flexibility in speed, and the possibility of flying at lower speeds than heretofore, it being recognized that the ability to vary the speed of a

In the way of records there is little to report, the war intervening about the time the important competitions were due; but mention may be made of two titions ware due; but mention may be made of two flights from Paris to Cairo, one by way of Constan-tinoper in eight stages. The altitude record appears to have gone to Linnenkogel, who attained 21.654 feet, as against 19,685 for last year.

A feature to which increasing attention has been given is automatic stabilizing, and many devices for the purpose have been invented, some of which have given really wonderful demonstrations of their powers, notably the gyroscope controlled device shown by Sperry

The efforts for the improvement of aviation have en directed almost exclusively to purposes of war fare, but anything that tends to perfect aeroplanes in this direction will also be largely applicable to machin used for commercial purposes. As a fighting machine the aeroplane surpassed expectation, and for the work of scouting and observation it has proved invaluable in the present war.

More powerful motors have made possible machines of greater speed and also greater carrying capacity, as was evidenced last year by the appearance of the great Sikorsky plane; but development in this direction has apparently been slow.

What promised to be the sensation of the year was the flight across the ocean, in which but one candidate for the prize developed; but unfortunately, or possibly fortunately, the outbreak of hostilities necessitated a postponement of the plans.

is interesting to note the experiments n Curtiss with the flying machine built by Prof. Langley, which demonstrated that if a proper method of launch ing or starting the flight had been employed the flying machine would have arrived years ago.

Automobiles.

The only really marked novelty in the automobile field is the very recent introduction of the eight-cylinder motor, which will undoubtedly give the even, continue torque that means so much for smooth running and increased flexibility of power and speed that is expected.

Outside of this matter of motors, the story of the past year has been one of refinement in various details and perfected standardization and processes of manufacture. Bodies have come in for a large share of attention and more careful study has been given to the artistic harmony of lines and proportions. Special efforts have been put on electric starting and lighting, and in these directions considerable improvement is noted both

in durability and reliability. Efforts are also being made to produce a satisfactory and reliable device for automatically changing gears and several on different principles have been introduced that indicate much

Although m otor trucks and com erally have arrived at a very practical stage, it is to be regretted that they have not been more generally adopted. The trouble appears to lie mostly with the users, who overload, abuse, and neglect their machines and then condemn. The demonstrations of the value of motor trucks in the operations in the European war, where they are absolutely indispensable, will undoubttend to awaken the commercial user to their advantages

The year opened with considerable interest in cycle-cars, just about the time they were meeting the fate abroad that is sure to overtake an immature idea everywhere. While an interesting novelty, the cyclecar has been little more than a toy, essentially of French origin, and later taken up in England. It did not take long for the more practical men of that country to recognize the shortcomings and limitations of the design and to jump to a logical conclusion by bringing out the light auto mobile. In this country a swarm of promoters started a cyclecar movement, which, following the history of English movement, has failed to show signs of vitality; but a few far-sighted men with better practical knowledge of the requirements of the road vehicle have introduced really good automobiles of light power and low price which will undoubtedly take a permanent position in the market. Whatever else the cyclecar may accomplish, it has at least served a good purpose in hastening the development of a type of car that will meet the requirements of a numerous class of people

Astronomy.

On July 21st Mr. Nicholson of the Lick Observatory photographed a faint object in the vicinity of Jupiter, near the eighth satellite, but still fainter. The new body proved to be a satellite of the great planet—the ninth to be discovered. This discovery is by far the most important of the year.

One of the principal events of the year was the total dar eclipse which occurred on August 21st. The mo favorable stations for scientific observation were located A number of expeditions established them Russia. selves at various points along the Russian part of the The intervention of the war unquestionably interfered with their work, but enough of them performed their tasks sufficiently well to complete the long record of eclipse observations.

On the 7th of November there was a transit of Mercury across the sun's disk. The scientific interest of a transit of Mercury is not very great, being confined to the exact observation of the times of the apparent "contacts" of Mercury with the sun's limb, which gives val-uable data for determining its exact position in its orbit.

The first comet to be discovered in 1914 was detected y Dr. Kritzinger of Bothkamp, Germany, on March 29th. The second comet to be discovered in 1914 was found by Zlatinsky at Meltau, Russia, on May 15th. On September 18th Mr. Leon Campbell of the Harvard Station at Arequipa, Peru, discovered a comet which also independently discovered at the Cape of Good Hope. Although Delavan's comet was discovered in 1913, it was a very conspicuous object in the October sky of 1914. Indeed, it appeared to the naked eye fully as bright as a third magnitude star and had a tail several degrees in length.

It has long been a question of much interest whether we receive heat from the stars, and if so, how much. Until recent years all attempts to detect and measure the almost infinitesimal amounts of energy which are radiated from the stars met with little success. No very great advance was made in this very difficult field until the present year, when Dr. Coblentz of the Bureau of Standards reported upon his work at the Lick Observatory. His apparatus will give distinct indications of the heat received from stars so faint as to be invisible to the naked eye. It was invariably found that for the same visual brightness a yellow star sends us more heat than a white one and a red star more than a yellow. Speaking roughly, Dr. Coblentz declares a w star of spectrum like the sun gives out twice as much energy for "heat" in proportion to its light than does a white star like Vega or Spica; while a red star like Antares radiates three times as much heat as a white one of the same apparent brightness.

The distinguished Dutch astronomer, Prof. Kapteyn,

published an admirable investigation on the motions of stars which show in their spectra the dark lines of helium. As a result of his exhaustive studies of the motion of helium stars, Prof. Kapteyn has obtained conclusive evidence that almost the whole of the stars of this type in a huge region of the sky, 60 degrees wide and 140 degrees long, extending for 30 degrees on each side of the Milky Way from Argo past the Southern Cross and Centaurus to Scorpio and Ophinchus, ar moving together relatively to the sun at least.



Loading a Paris stage with meat.

Military Tactics and the Motor

How the Power Vehicle Has Created a New System of Attack, and Defense and Has Lessened the Chances of Cutting Off an Army from Its Base of Supplies



Chauffeur's port in Belgian armored car.

OUT of the chaos of conflicting and vague reports from the European battlefields there arises clear and pre-eminent the eulogy of the automobile and motor truck. Put to the test of war conditions for the first time since its invention, with the exception of its very limited use dur-ing the last Balkan war, the gasolinedriven motorcar has more than fulfilled the expectations of its advocates. It has almost become a tiresome "bromidfom" to say that the modern motorcar has been an important factor in the rapid concentra-tion and transportation of armies, and that but for the motor the Germany army within twenty miles of Paris in the short space of four weeks. Even the most cur-sory reader of the daily press has been given to understand that the German attack in August was an attack by automo-The attack failed; the armies have been locked in Flanders and along the eastern frontier of France for months. But the automobile has lost nothing of its importance. It has simply taken up other

To give in detail all the work performed within and behind the battle lines in France and in Poland and Galicia would require a full issue of the Scientific American. So complete and important is the work of the motorcar that there is not a single military operation without its help or without feeling the effect of gasoline in some of its phases. From hurling cannon and armored cars at the enemy, to observing his operations behind the lines, carrying fodder and provisions for men and beasts; bringing aid to wounded, ammunition for the artillery and infantry; carrying high officers at express train speed between the various headquarters, and capable engineers from point to point along the battle line where their presence is most necessary, and a host of other incidental performances—all are "in the day's work" for the modern military auto-



Photograph by Menra

How motor cars serve as ambulances.



Photograph by Paul Thompson.

Wire cutting guard used on German cars.

mobile, and will continue until the end.

Motorcar Resources.

In speaking of the "resources" in motorcars in a country it is of course necessary to take into consideration that in Great Britain the government has not quite the same power to commandeer touring cars for the army as the Continental govern-ments have. The Royal Automobile Club and its affiliated organizations have placed at the disposal of the British government about 15,000 touring cars, with drivers or owner-drivers, and the government itself has "impressed" somewhere near 6,000 motor trucks and has converted about 800 touring cars into armored cars by means of inclosing the car in thin steel shields. These converted touring cars, built to carry on an average not more than 3,500 pounds on the chassis, now are compelled to carry between 7,000 and 8,000 pounds, with the result that crystallization and breakage of chassis side frames is of rather frequent occurrence. In addition to strictly military vehicles, the govern-ment has received from private sources more than five hundred well-equipped ambulances, a great number of these being mounted on American chassis (Overland, Buick, and Ford).

In the case of France and Germany, the motorbuses and interurban motor passenger coaches have proved of tremendous value. Germany has an extensive system of passenger coach transportation run under the jurisdiction of the post office "mail coaches." More than 3,000 of these sturdy and capacious vehicles have been transformed into military vehicles, especially for meat transport to the front. The same must be said of the French buses, long lines of which may be seen at all times several miles behind the battle front.

The military authorities foresaw the great service that power wagons in general were called upon to perform in the event of war, and, as in all the leading countries, they endeavored to have all the

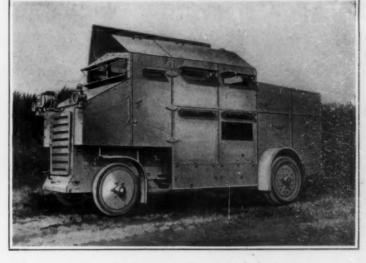


Copyright by Underwood & Underwood

The Canadian contingent on review at Salisbury Plain, England. The cars were built in the United States.



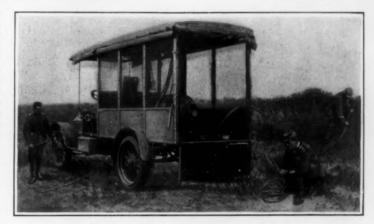
Belgian armored car, showing the revolving turret.



Heavy English armored car, a fort on wheels

power wagon trucks including the ones used with autobus body, built according to the general standard regulations laid out by the War Department. In this way the trucks of the autobus are in reality a type of power wagon chassis which conforms to the same standard rules as apply to the larger power cars. The Paris bus employs two different types of motor and truck combination, one being designed by the Schneider works, the great artillery and machine works, and the second by the De Dion automobile builders.

Since the war broke out the autobuses have entirely disappeared from the circulation in the city and the whole number of these cars has been enrolled from the very outset of operations in the carefully planned service for supplying provisions to the army on the field. No less than 1,100 buses were thus available, and they are now engaged in following the troops in the course of the battle. About 900 of m were taken for the transportation of fresh meat in quarters, and the inside of the vehicle was quite transformed by tak-ing out all the seats and partitions so as to leave a roomy space for holding the quarters of beef, these being, as a rule, hung upon hooks from the roof. A single autobus can hold a very large number of pieces, so that the whole fleet is able to handle enormous quantities of meat, such as are needed for the immense number of troops engaged in the war. The remainder of the vehicles, or about 200, are designed for the transport of troops, and this can be done in a very rapid manner on occasion, either to help out the railroad or in other cases where railroad facilities cannot be had. Again, for emergency cases or rapid maneuvers, a considerable number of troops can be instantly sent to a certain point of the battle either in autobus or on other kinds of power wagon, and this might often change the issue of events. It is also probable that a few of the buses are fitted out for ambulance the bus work, and one of our photographs shows



Motor truck fitted with an electric generator for field use.



German prisoners conveyed by motor truck to Châlons sur Marne.

a bus transporting some of the Algerian

Owing to the careful construction of the automobile chassis and motor, the cars go through their daily work on the battlefield with their heavy loads, and the military authorities are more than satisfied with their performance. It was considered fortunate that just within a few years Paris had adopted the present extensive autobus system, which led to building over a thousand cars a short time before the broke out. As to the way the cars stand the wear of this hard service, they say it is very good, and with the exception of three or four cars laid up and four or five in repairs all of the great fleet of buses continue to circulate over the roads.

Turning to the question of transporting the food supplies for the troops, and espe cially the handling of quarters of beef, the present organization is excellent. Large troops of cattle follow the armies over the roads and are convoyed by sol-diers. At the headquarters where the troops are stationed a suitable place is selected in a town or village or at any chosen spot along the route and improvised abattoirs are installed, usually in buildings and grounds, where the mobilized butchers are at work slaughtering cattle and cutting up the beef in quarters. From the abattoirs the autobuses receive the meat, which the soldiers load upon the vehicles in rapid order; then the fleet of cars start off upon the road to a point lying nearest the battlefield. Here the meat is changed over to the covered army horse wagons of light build, and these are able to travel over fields or other ground so as to reach the rear of the fighting line; then the army cooks receive it and proceed

then the army cooks receive it and proceed to prepare the rations for the men.

Watching the Motor at Work.

The popular conception of lines of infantry in trenches, interspersed with motor convoys loaded with ammunition, etc., is pure folly. Motor convoys are miles



Convoy hiding in the woods from a hostile aeroplane.



Carrying supplies to the British troops.

The Car of 1915

Some of the More Important Changes Ushered in With the New Year

By S. P. McMinn, M.E.

DURING the past twelvemonth there have been a number of developments in the motorcar world, which, perhaps, are not as plainly apparent to the layman as they are to the student of matters gasoline. Also, there are a number of trends of the times which must be plainly apparent to all who have eyes to see.

Not the least important of the developments of the past year has been the commercializing of the eightcylinder motor. Or should we say popularizing, for the motor of this type long has been successfully used by our brothers across the seas. But it is characteristic of American progressiveness that those who have been

Instruction in the control of the control of the construction of t

An eight-cylinder motor.

Instrumental in bringing the eight-cylinder motor to native heather have not been content to follow blindly the example set by French pioneers. In constructional features and design they might have looked far and perhaps in vain for better engineering in so far as the mere drawing of the plans is concerned. But engineering extends further than the draughting table; it extends out

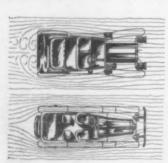
on the roads and comes close to the pocket-book of the ultimate consumer. So American engineers have been free and frank in their adoption of practice long acceptable abroad, but they have applied to it American engineering principles; which means, briefly, quantity production and a popular price. As a result, we now have two American eight-cylinder motors, one selling for just under \$2,000 and the other selling for less than \$1,500. Shall we have more? It seems more than likely.

From the eight-cylinder motor it is but a step to the motor with twelve cylinders. So far only one foreign maker has attained success with this type of motor, and here again it is characteristic of American progressiveness that already several well-known American makers are known to be experimenting with motors of the kind. Whether the experiments will bear fruit, whether we shall see twelve-cylinder motors competing with eight-cylinder ones, remains for the future to bring forth. And in this connection it must be remembered that there were those who were outspoken enough to predict that the eight-cylinder motor never would become popular under the American flag.

The light-by-comparison six-cylinder car which was such a feature of last year's crop of machines continues to hold its own, though it might require a stretch of the imagination to see it making the strides that were freely predicted for it. As a matter of cold fact, the still-lighter-by-comparison, small, high-speed, four-cylinder motor appears to have made greater strides in the year, and by comparison, than has the six. Another significant feature is the increase in the number of cars which sell at or near to the \$1,000 mark.

of cars which sell at or near to the \$1,000 mark.

At the same time it is interesting to note that the well-defined division which existed between the miniature car and the larger one fast is disappearing. It has come to be regarded as distinctly unhappy and undestrable that there should be any division as between classes of cars. Instead there is a marked tendency to place all four-wheeled vehicles in the one class. The so-called cyclecar, for instance, has been practically pushed over the horizon, and it is now a motorcar pure and simple. This may also be taken to mean that the narrow tread appears to be passing. Already a number of makers of narrow tread cars have widened them to track 56 inches and others give evidence of



"Streamlines."

appreciating the failing popularity of the narrow tread car by offering the option of either narrow or standard width.

The outward appearance of the car of 1915 has not changed very much. Yet

there is a subtle something which almost involuntarily brings to mind and expression the saying: "Clean as a hound's tooth." The blending of lines, which first gave promise about four years ago, when fore doors on touring cars were one of the dominating notes, has become an established fact, and practically every car, regardless of class distinction, now has the streamlines which last year were a feature of a comparatively few.

This term "streamline," by the way, has become a common one, yet there are not many among the ranks of motorists who know its significance. It means, briefly, that the designer has taken advantage of the entering wedge principle, and has at least in part converted wind resistance to his own uses. In other words, he has conserved some of the wasted energy represented by displaced atmosphere by training the eddy currents to help push the car along.

He has done this by tapering the engine hood and in

The pointed radiator.

fitting a pointed radiator; by gently flaring the body sides and carefully eliminating all external protuberances; by clearing everything off the running boards; by

rounding the fenders; by giving thought to body lines at the rear, where once no thought was bestowed. The result, of course, is a much more efficient car and one which is driven on less gasoline and lubricating oil.

Here are two notable examples of how far the smoothing process has been carried by two makers in

the popularprice class.
One of them
has even eliminated the
tim e-honored
and not always
sightly radiator filler. He
has placed it
beneath the en-



The radiator filler concealed.

or rather in, a

deep cowl over

the driver's feet

where before

there was waste

space, or at the

rear of the body.

This was one of

tendencies last

year. The cowllocated tank in-

dicates no diffi-

culty in feeding

the fuel to the

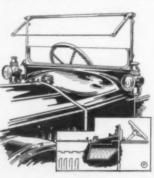
carbureter, for

noticeable

gine hood, and in this way obtained smoothness where it was not obtainable before. The other has substituted for the usual door latches a magnetic device, which is entirely inclosed both inside and outside. To open the doors you merely press a button.

Left side drive is now almost universal, and there is nothing new in that except its widespread adoption. There are not more than three or four makers who still adhere to the right side position for the steering wheel.

Quite generally, now, the fuel container is carried either beneath,



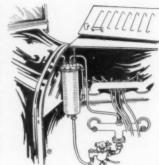
The cowl tank.

gravity may be relied upon. But the rear tank has been responsible for the development of a new method of getting the gasoline from the tank to the engine. The use of pressure feed is open to many objections, and now the necessity for it has been obviated by the development of what has come to be styled vacuum feed.

This vacuum feeding device, which now is quite common and bids fair to be more common, consists of a small tank placed generally on the forward side of the dashboard. There are two compartments to the tank, the upper compartment being connected to the main fuel tank and the lower to the carbureter. The suction induced in the intake manifold of the motor is

caused, through suitable piping and valves, to draw fuel from the main tank into the upper compartment, whence it drains by gravity into the lower compartment and thence to the carbureter. The device is entirely automatic in action.

Along with the convenience that comes with center



Vacuum feeding device-

gear shifting and emergency brake levers, there is a well-defined tendency to place all other control devices within easy reach of the operator. Thus, for instance,



Switchboard on the steering column.

switches, carbureter adjustments, etc., now are being placed on what have come to be styled cowl boards, directly in front of the driver. At the same time, there is a noticeable trend toward the adoption of switchboard units mounted directly upon the steering column.

Wire wheels may now be had on the majority of cars at a nominal extra cost, though there are not many makers who supply them as standard equipment. That they have made some advance there is no gainsaying, though it likely will require another year before they are entitled to the descriptive adjective common.

In the vitals of the car, one of the most noteworthy features, as already has been chronicled, is the increase in small-bore, high-speed, four-cylinder motors. The increase in the type has served to draw attention to the fact that the method of casting all four cylinders—and in the case of six-cylinder motors all six cylinders—

in one block grows apace. Another of the past year's developments which has lived up to its promise is the steadily increasing use of a detachable cylinder head. This construction simplifies somewhat manufacturing operations and at the same time increases accessibility and facilitates the easy removal of carbon deposit. The use of cored intake and exhaust passages also

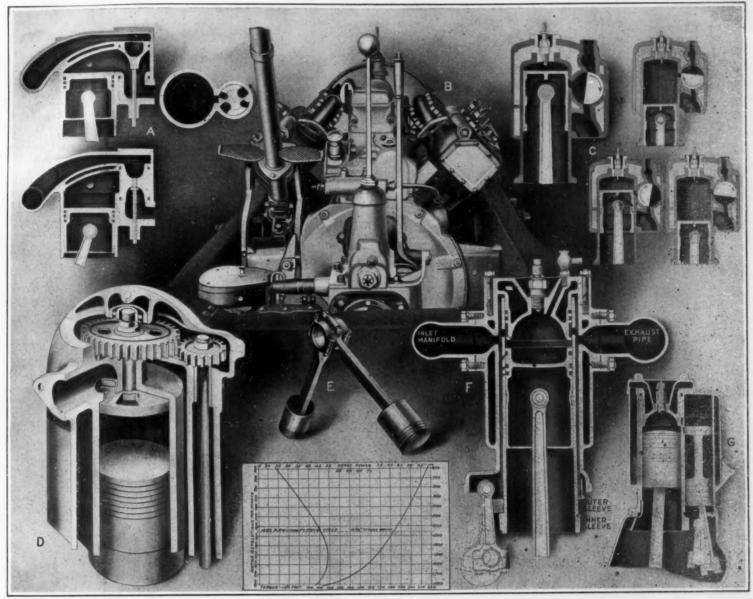


Detachable cylinder head.

shows a slight increase. With the now almost universal adoption of electric lighting and engine starting equipment—there are not more than three or four makes of cars on which this equipment is not listed as standard—has come what may be styled a logical reversion to battery ignition. Given the storage battery as part of the car it is such a comparatively simple matter to arrange to draw current from it for ignition that quite a number of makers have eliminated high tension magnetos as a result. Others, however, prefer the proven reliability of the magneto and the complete isolation of ignition and lighting functions. But on the popular priced cars the modern battery ignition system, brought to the plane of perfection where mechanical and electrical lag has been practically eliminated, undoubtedly has won a place for itself and will not soon be ousted.

The lightening of reciprocating parts goes forward, and of late still greater attention is being paid to the necessity for more perfect balancing. As a concrete example of this fact we might state the case of one maker of Knight motors who has adopted the practice

(Concluded on page 36.)



Various types of high-speed motors.

A, odd rotary valve action of the Italia motor; B, the eight-cylinder Cadillac motor; C, action of the Darracq D-form valve; D, the Reynolds rotating valve disk; E, pistons of the Cadillac motor; F, valve sleeves of the Knight motor; G, the Miesse combination sleeve and piston valve. The chart shows a laboratory test on a four-cylinder 5 by 5½ slow-speed motor for power and torque. The strangling effect of the valve is plainly apparent.

The High Speed Automobile Motor

Relief it Promises From the Growing Burden of Weight and Increased Running Expenses

By Charles F. Barrett

In spite of the large amount of discussion and experiment on the subject of the high speed gasoline motor for automobile use, very little progress has been made so far on this side of the water in the perfection of such units along successful commercial lines. In France and Germany, and particularly in the former country before the war broke out, wonderful results had been attained with this type of motor, although not in any marked degree as regards size of output, when the latter is judged from our American standards.

is judged from our American standards.

On close analysis of the problems encountered in the commercializing of this type of motor in this country two or three facts stand out prominently as having a vital bearing on the situation. One of these is largely psychological; one a result of habit, and the third based mon actual structural difficulties.

upon actual structural difficulties.

The first two of these really date back to the very beginning of the industry in this country and relate to the early impression formed by motorists of the satisfactory speed of the motor as well as its control by the gear changes. Most of the pioneer manufacturers were so engrossed in the problem of actually making their motors run that they gave little heed to the important subjects of vibration and balance. The result was, naturally, a very disagreeable vibration whenever it was necessary to speed up the motors on either low or high gears, and a popular dislike was therefore created for small bore motors which of necessity required relatively low gears and frequent gear changing.

Consequently the demand was for large bore, relatively slow speed motors which could be geared fairly high and thus loaded down sufficiently to hold the un-

balanced effect within reasonable bounds. The poor balancing evil thus caused an unwarranted prejudice against the high speed motor right at the beginning of the industry, and having once started in this rut manufacturers naturally took the path of least resistance and, instead of attempting to swing the public back in line, encouraged them to keep on believing that the slow speed motor was the correct type with no alternative.

speed motor was the correct type with no alternative.

Hand in hand with this development came a strong liking for high gear driving. The infrequent gear changing necessary with the large bore type of American automobile motor has undoubtedly taken firm root upon the majority of motorists in this country and the habit resulting from long use of this form of control has been practically a national characteristic.

It is therefore necessary to realize at the outset these two basic dislikes of the American for the high speed motor; one, an old, moss-grown suspicion that vibration and poor balance go hand in hand with high speed, and second, a genuine hatred for gears and gear changing. The latter feature cannot, of course, be separated thoroughly from high speed design, because the torque falls off so rapidly when the motor speed is pulled down that slow, high gear work under load is not practical, and gear changing must be rather frequently resorted to, with four cylinders or less.

It has taken years to overcome this deep-seated prejudice of the motorist in this country for the so-called high speed type of automobile motor and there is no assurance that it has been overcome even now, but there is at least some marked evidence of widespread kicking against the ever-increasing cost of the present type of

motorcar, particularly as regards upkeep. This is beginning to cause a decided reaction in favor of the high speed type on account of the relief which it seems to promise for a very material reduction in the present burdensome total car weight with its chain of expense. In other words, we are fast getting into a mood to accept what appears like a lesser evil in order to overcome a greater.

reper what appears like a lesser evil in order to overcome a greater.

It should be said for the large, slow speed type of
motor, however, that during the early period of the
industry it was unquestionably the most practical type
from the purely manufacturing standpoint. Just as the
introduction of the successful automobile itself was contingent upon the development of the high grade alloy
steel, so the high speed type of motor has had to wait
for the perfection of valve mechanisms, lubrication and
other vital features, before it could be considered a
feasible proposition.

On the structural side of the problem there are four principal features which demand careful handling in the design and manufacture of this style of motor, as hinted at above: First, relative proportion of parts; second, valve mechanism; third, lubrication, and fourth, balance. Any one of these is fully as important as the other three, and whereas in the slow speed type if some of these conditions were not perfectly fuifilled it did not necessarily spell failure of the motor: in the case of the high speed type, it would mean utter impracticability.

The high speed automobile motor calls for a most exacting proportion of all component parts; a careful,

(Concluded on page 37.)

The Storage and Handling of Gasoline in the Garage

A Discussion of the Various Systems in Use

By Herbert T. Wade

THE chief aim in the construction of a garage should be to provide an absolutely fireproof structure, and this condition is insisted on more or less in municipal and insurance regulations. The modern concrete building has facilitated a fireproof garage in a marked degree, but distinction usually is made in official regulations between public and private garages, with naturally considerable leeway in construction for the latter. Given the garage, the storage of gasoline involves compliance with such requirements as those of the National Board of Fire Underwriters and municipal authorities, for it must be remembered that from the time the drums or barrels of gasoline are delivered at the garage it is a source of increased hazard to the premises and the surroundings.

The safety of property must be considered before any questions of convenience and expense to the garage owners; and while gasoline must be stored where it is subject to a minimum of loss by evaporation and where it can be supplied readily to the motor vehicle, yet it must be in such a place that the least possible danger will result from leakage or from the escape of vapor that may be reached by a chance flame or spark, not to mention the actual loss in fuel itself by evaporation, especially in summer, or with rapid fluctuations of temperature. There must be some pumping and piping system for its distribution, for insurance and fire regulations generally forbid the handling of gasoline in open containers.

Naturally there is the greatest safety when the gasoline is kept underground, and experience has shown that with a properly vented and otherwise protected storage tank underground adequate safety can be secured, irrespective of the size of the tank or the quantity of liquid contained. Tanks above ground are permitted by fire and insurance regulations only under special conditions and in rural districts. With the gasoline stored underground there is no danger from evaporation or leakage and consequently whatever troubles are encountered must be found in its handling, and here likewise it is necessary that suitable precautions be enforced.

To remove the liquid from a buried tank some form of pumping system is required, and this may vary from a simple hand-lift pump to a motor-driven pump or a system employing hydraulic or gas pressure. Naturally the pipes must be made tight by cement, impervious to the action of gasoline, properly protected, and so arranged that the filling hose or other outlet appliance is with us to present a minimum of right.

such as to present a minimum of risk.

The underground tank is made of galvanized sheet steel or wrought iron, riveted, welded or brazed, the material, thickness and other essentials complying with specifications prepared by the Underwriters' Labora-tories or equivalent specifications of a local authority. Such a tank is buried below the ground at least three feet and may have separate fill and suction pipes and a vent pipe terminating some distance above the tank in a goose neck. The fill pipe when not in use must be capped properly and protected from access of air, being arranged so that it can be locked to prevent tampering. and it should extend to the bottom of the tank and contain one or more strainers of wire gauze, which als afford protection in case the flame should reach the fill The suction pipe, which must be at no point lower than the top of the tank to avoid explosion or gravity action in case of fire, naturally leads to the pump and may be supplied with various valves and strainers as may be required. The best forms of suction pumps deliver a steady stream of fluid through the hose to the car or to some form of portable receptacle, such as a bucket or safety can.

Wherever simple pumps are able to furnish adequate supply a hand pump is to be preferred, even for a garage of considerable size, as the supply ceases when the attendant stops pumping. Such pumps are located in proximity to the place where the discharged supply is to be utilized and there may be a considerable length of line communicating with the underground tank. With such a pump and tank system it is found desirable to introduce a number of additional features so important as to be considered almost essential—for example, a device at the pump to drain back into the tank any surplus gasoline, and various straining and measuring appliances, the latter also recording the amount of gasoline actually delivered.

As the size of the installation is increased the pumping and distribution system naturally becomes more complicated, though essentially it is the same as in the simple installation, and if power pumping is introduced automatic devices usually are applied to stop the flow

after a predetermined quantity has been delivered. In a large garage a measuring pump is essential, and these are supplied in various forms, with its cylinder carefully graduated so that each stroke of the piston delivers a fixed quantity of gasoline, the amount of which may be regulated by certain adjustments so that from one pint to five gallons may be delivered at a single stroke of the pump piston. The most complete pumps also have a meter registering the quantity of gasoline delivered, a filter and two-way nozzle, and a hose with portable nozzle for convenience in the operation of filling a car

While the location and size of the tank may vary with local fire department or other regulations, whatever its size, the systems in general nature are essentially the same, and our illustration shows a gasoline supply station located at the curb with the storage tank buried under the sidewalk, though the general arrangement would apply equally to a large garage with a battery of tanks and a number of pumps. The arrangement shown with its red pedestal is familiar to traveling motorists. Such a tank is filled from drums or barrels or a tank wagon through a fill pipe reaching to the sidewalk, while its vent pipe extends to the side of the building and rises to a considerable height. These pumps must be constructed tightly fitting and of a design approved by the Underwriters' Laboratories, by whom they are labeled, and their accuracy should be carefully certified by local sealers of weights and meas-

A large public garage, where the gasoline is stored and handled by pumps, may be operated by a rem control system which can deliver the fluid from a storage tank, sometimes of as much as 11,000 gallons of In one such type of installation a centrifugal pump connected to an electric motor is located at convenient place within the suction distance of the rage tank. On the discharge line from the pump, which may extend up through several stories, one or more remote control, automatic, self-registering pipe line measures, equipped with oil separators, strainers, tc., are placed any distance from the pump conv for using. The measure or measures are operated from special electrical control equipment opened or closed either by hand by the attendant, or, if automatic appliances are introduced, the supply will be shut off automatically by the measure when the predetermined quantity has been recorded. This system has been elaborated so that several lines of hose may be connected with a single pipe line and by the use of an automatic control valve, so that a discharge end may be

located at the curb for the use of tourists.

Although a mixture of gasoline vapor and air is highly explosive, yet so safe are these underground tanks when duly protected that at the time of the San Francisco fire one hundred and eighteen of the outfits of a single manufacturer installed in that city were found intact, and the inflammable fluid contained was pumped out and removed with a surprisingly small shrinkage from leakage and vaporization, not to mention complete protection from the fire. In one case a tank was found to contain over 200 gallons of gasoline after an interval of three years.

The distribution system based on the simple pump has the advantage of being complete in itself without connection with water, sewer system or compressed air, or requiring any outside material. It answers for installations of any size and the only essential is that there must be a supply of gasoline in the tank.

Mention here might be made of the familiar portable tanks where a number of cars, especially in garages or along the roadside, must be supplied with gasoline, and an elaborate system of piping is not desirable or feasible. In such an installation storage tanks are maintained with outlets and valves at convenient points, especially of the various floors of garages with several stories, and from them are filled portable wheeled tanks from which the gasoline is supplied through measuring pumps and hose with strainer nozzles to the individual cars as required, the portable tank being brought up to the car at its place of rest. The design of these tanks as well as the number is usually regulated by local insurance and fire regulations, tightness and stability being, of course, prime essentials, and as they can be moved by one man readily, they are convenient for transferring gasoline and reaching cars wherever they happen to be placed.

As contrasted with pumping systems where a simple

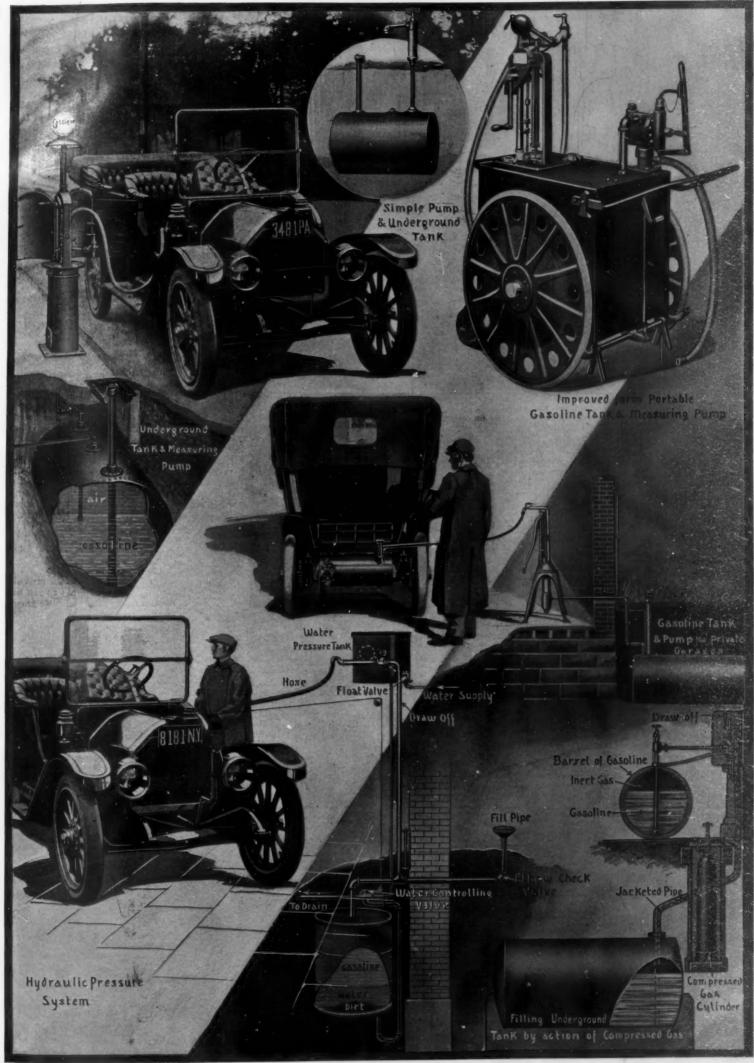
As contrasted with pumping systems where a simple air pump raises the gasoline, there must be considered the hydraulic system, where water pressure is the motive force. In these there is no air at all in contact

with the surface of the gasoline, with the possible production of an explosive mixture, and the gasoline can be measured accurately both on admission to the tank and on being discharged, since in the latter case the liquid flowing through the meter is pure gasoline and not a mixture of air and gasoline or water and gasoline, which cannot be recorded satisfactorily. The hydraulic system is used in garages of all sizes, from the simple private installation to such a one as that of the American Express Company in New York with 500-gallon tanks having a capacity of 13,000 gallons. It acts on the following principle. The gasoline is contained in an underground storage tank which connects by a U-tube with a water pressure tank at such height as to furnish sure based on the difference between specific gravity of water and gasoline and the distance to which the gasoline is to be delivered. This water tank is filled from the city mains and a float-cock maintains a constant level pressure. If water from the tank is admitted to the system by opening the three-way valve it will flow through the U-tube and into the gaso-line tank, rising to an equal level in both arms of the The gasoline on being discharged from the drum or barrel is admitted through the filling pipe and flowing down on top of the water in the supply tank causes the water below to be discharged through the drain at the water controlling valve on the water sup-The gasoline stays on the surface of the water and the dirt settles to the lower part of the tank. On account of the lesser density of the gasoline a higher column will balance a lesser column of water in the proportion of 17 to 11, these figures representing the relative density of water and gasoline. When it is desired to draw off the gasoline this valve is opened, so that the pressure of the water in the tank acts on the oline in the storage tank, forcing it up through the draw-off pipe into the hose used for filling the tanks of the cars, a check valve preventing its return through the filler pipe. When sufficient gasoline has been passed into the tank of the motor vehicle or other receptacle the valve is closed, cutting off the water pressure from the pressure tank, and the normal condition of the liquid in both arms of the U-tube is restored. The amount of gasoline drawn off can be measured from a meter placed in the line of the draw-off pipe, and since the amount of gasoline supplied to the storage tank obviously must be equal to the amount of water displaced, which flows off through the drain, an accurate water meter can be installed in the pipe line to the drain to measure this quantity. Chief of the advan-tages is that the clean gasoline can be drawn off from the top of the tank and it is impossible for water or dirt to be drawn with it. There is no vent pipe open to the air or surface of gasoline in contact with gasoline. Furthermore, there is no air space, as the tank is always full of liquid, and hence no evaporation can take place or generation of explosive gases. The dirt and water at the bottom of the tank are forced into the drain when the tank is refilled. Like other systems which fill directly the main tank, no portable tanks are required, so that there is a minimum of fire risk. There is, of course, a waste of water through the drain, but the expense for this under ordinary circumstances is relatively small. In addition to air lift and hydraulic systems, there

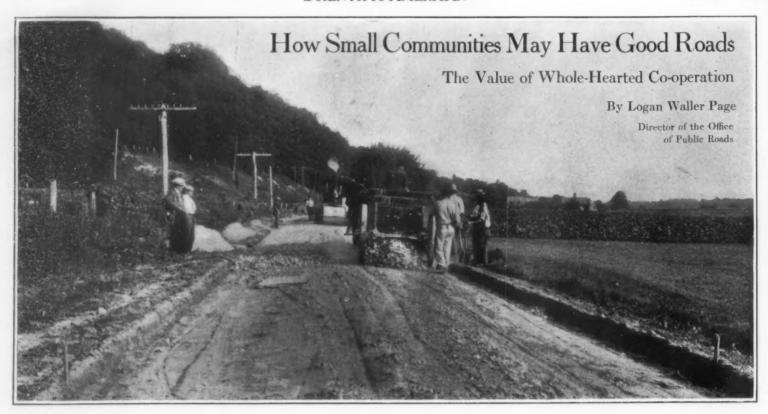
In addition to air lift and hydraulic systems, there have been employed extensively in Europe systems which use as head an inert gas such as nitrogen or carbon dioxide in contact with the surface of the gasoline, and carried in an annular space or jacket surrounding all pipes through which the inflammable liquid passes; as combustion is impossible in the presence of either of these gases their effect is obvious. The most notable of these systems, whose principle of operation is indicated in the illustration, was described in the Scientific American for July 18th, 1914. Its safety has been fully demonstrated not only in garages, but also in other establishments where large quantities of inflammable liquids are stored. It possesses the disadvantage of being dependent upon compressed gas supplied in cylinders to furnish pressure acting within the tanks. It is, however, thoroughly fireproof, and when well installed, as it has been in Europe, has supplied adequate protection and secured general official approval.

All of these systems have met with the approval of

All of these systems have met with the approval of insurance authorities and where they are installed they are meeting the requirements. Care and maintenance enforced by insurance and official inspectors, however, are quite as essential as original installation, but the tendency toward uniformity and codification of local rules is bringing about a much more satisfactory and safer condition of affairs.



THE STORAGE AND HANDLING OF GASOLINE IN THE GARAGE



THE public roads in the United States, outside of incorporated towns and cities, have a total length of 2,228,042 miles, of which only 229,219 miles, or a trifle more than 10 per cent, are improved with any form of surfacing. Any means which promise to increase our small mileage of improved roads should, therefore, be given consideration and utilized to the fullest extent possible, with due regard for true economy and proper

Possibilities in Co-operation.

The marked success of certain co-operative undertakings by farmers and rural communities, especially in the marketing and distribution of agricultural projects has given the mere word "co-operation" a certain standing and distinction as indicative of the successful solution of all problems. But co-operation is to be judged from the results obtained. Certain forms of co-operation are efficient and successful, while others, even though seemingly successful, are extremely inefficient and entail a large waste of energy. For example, in certain sections, it has become popular to proclaim "Good Road" days, on which everybody is supposed to don overalls and labor on the roads. This is very commendable as a demonstration of interest and enthusi-asm, but so far as securing adequate returns from the energy expended, it is far from ideal. It is, in fact, but a variation of the old system of statute labor, of which we have been trying so hard and so long to rid ourselves. The main distinction is, that in this case the labor is voluntary and made somewhat less onerous because of the hurrah and attendant advertisement. It sounds good to read in the papers of the eminent statesmen, bankers or men of business donning overalls and laboring with pick and shovel to mend our ways. This,

no doubt, furnishes adequate compen muscles and the few blisters, but how about the effi-ciency of this labor? If anything has ever been clearly demonstrated, it is the inefficiency of unskilled labor in road work. The time of the business man who cheerfully gives up his energy in more or less misdirected efforts to improve our roads can, on the average, probably be placed as worth at least the equivalent of five days of a common laborer, trained and efficient in doing this class of work. As unskilled labor is rarely more than 50 per cent efficient, it follows at once that this much advertised bit of altruistic endeavor, however, commendable from an idealistic point of view, is from the standpoint of economy only 10 per cent efficient.

Economic Efficiency the Test.

Co-operative as well as other public undertakings must ultimately stand or fall before the searching test of economic efficiency. Any co-operative undertaking, no matter how commendable its object, ought never to be tolerated, unless it is more efficient than the system it displaces. Our endeavor should constantly be directed toward a system which will ultimately yield us 100 per cent efficiency.

This does not means that co-operative undertakings have no place in our public road system. From the very beginning of road building in this country the roads were considered a local burden, in the construction and maintenance of which all should co-operate, each according to his ability. Where a road lay on the boundary of two towns, or other administrative subdivisions, legal channels were fixed, whereby both would co-operate in the construction and maintenance. Later, as the more general importance of our public roads began to be understood, legal channels

formed for such varied co-operation as the abutting property owners, the town, the county and the State. To-day, neither townships, counties, nor even State lines limit the general interest taken in the condition of our roads. The automobile and the motor truck have made the conditions of the roads of the country of direct interest to all. The automobile and the motor truck demand better and more permanent types of construction. Through routes or trunk-line roads have become a necessity in some localities. Certain branch roads and feeders are of only slightly less importance. From 60 to 75 per cent of our roads, however, still carry little or no through traffic, and so remain primarily of local

Trunk Lines and Branch Roads.

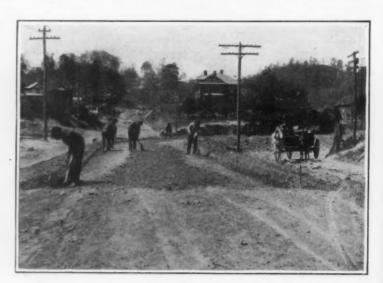
Most of our States have recognized these natural divi-sions of our public roads. No State has as yet, however, made this division on the purely scientific grounds of amount and kind of traffic carried, but several have made more or less happy attempts to secure the same results by utilizing, in general, our administrative units to make the several classifications. This has given us, in most States, a division into State or State-aid main most States, a division into State or State-and main roads, county roads, and town or township local roads. Massachusetts has only two subdivisions, State and town roads, while New York has four classes, State highways, county highways, county roads, and town

While most of the States co-operate only directly in the construction of State or State-aid roads, a few have already realized the importance of directing local cooperation for the improvement of our minor roads. New York and Pennsylvania have established State bureaus of town highways, while Massachusetts has established



Misdirected efforts.

e with a road drag, this might have been a good road



Properly directed efforts.

A trained and properly organize er efficient management can always be depended on to secure a dollar's worth of returns for every dollar expended

SCIENTIFIC AMERICAN

It takes more than enthusiasm and good intentions to make a good road.

newhat similar division for aiding and co-operating in the improvement of town road

Proper Planning, Management, and Funds Necessary When our highway system is viewed from the broad standpoint of its efficiency as a public utility, it becomes evident at once that there are three fundamental re-quirements which must be fulfilled: First, a properly planned, classified, and laid out highway system; se ond, a proper and effective system of road management; and third, the provision of adequate funds. From a study of these fundamental requirements, it can be seen that undirected co-operation between local communities is apt to lead to costly mistakes. A small community is not likely to view the improvement from the larger interest of the county or State, and systems of efficient management and skilled labor are generally Furthermore, the town or township is quently too small to form an efficient unit for road management and administration. The funds are too small to warrant the employment of a capable highway ngineer and the purchase of modern road machinery. Certain forms of co-operation are, therefore, desirable in order to secure a large road fund, skilled supervision and the use of efficient machinery. Vermont has solved this in part by the appointment of a county road super visor, who co-operates with the town road officials, and so, in a way, helps to co-ordinate the road work of the entire county properly. New York and Pennsylvania have established bureaus of town highways which direct and guide, to a large extent, the road work of the several towns throughout the State. The work is thus systematized, plans are standardized, and there is cooperation along definite and well directed lines

Various State Systems.

Other States have nearly the same system, but with a county unit instead of a State bureau. But, as the county organization is more or less subordinate and responsible to the State Highway Department, the dis the more important examples of this system are Iowa, Illinois, Wisconsin, and Minnesota. While there are many dissimilarities in the highway organization of these States, there is one fundamental and striking similarity, the effort to secure reasonable co-operation throughout the various units, and, at the same time, provide a fixed, definite responsibility for all actions. Other States, such as California and Montana, do not use the township organization in their road work. The

county is the unit, which may, however, be subdivided into districts according to the will of the Board of County Supervisors. The tendency here, however, is very strong against the old method of subdivision, and in favor of a county unit with a capable engineer in charge of the road work.

This explains why many of our States are formulating means for directing the work of the local communi-The most conspicuous examples of co-operation are to be found in such States as have a State Highway Department or Bureau, especially provided for giving efficient guidance and direction to work of this char acter. Under these conditions and with the above limitations clearly understood, co-operation between local communities in road building may be carried on with considerable succes

Preparatory Steps.

In making preparations for co-operation of this kind, the first point to be considered is that all our public roads are by law under the jurisdiction of one or more public officials. Before any definite work can be done, it is necessary to secure the consent of the officials having charge of the road to be improved, or what is far better, to secure their co-operation and support. ond step is to secure competent advice in regard to the improvement to be made. It would be extremely unwise, for example, to place a macadam or bitumino surfacing on a road where gravel or sand-clay would answer all the requirements. It would also be a waste of money and labor to reduce a grade to 1 per cent where a 3 per cent grade would answer as well. On the other hand, it would be just as much folly to place a gravel or sand-clay surfacing where traffic requirements demanded bituminous construction, or its equivalent, or to leave a grade 7 per cent where traffic demanded a 3 per cent grade. In other words, over-investment and underinvestment are both bad. Both lead



Working out the road tax.

loss of time and labor and money. The aid of a little really expert advice when the work is being planned will save the community much loss and needless worry. The second point may, therefore, be restated thus: Get competent advice as to what to do, and then follow it!

The third step deals with the actual construction of the road. This usually requires funds, labor, materials and the use of more or less machinery. these there is room for the exercise of any amount of The one



Road near Bowling Green, Kentucky, built by co-operation of the county and local farmers.

to secure the maximum efficiency from the expenditure of the funds and labor.

Example of Methods.

As an example of the great diversity of ways and means that may be employed in getting work done, the following cases may be cited: Nearing Bowling Green, Kentucky, the main market roads had been macadamized by the county. The local roads, however, were unimproved. A number of farmers decided to improve these branch roads, over which they had to pass in order to reach the main roads. During the plowing eason all the rocks encountered in the fields were picked up and thrown in piles. Later, when the crops were in, and time available, these stones were hauled to the county rock crusher. County co-operation had been secured to the extent of furnishing and operating a crushing plant and a road roller. The farmers then hauled the broken stone and placed it on the roads. The actual cash outlay of the county for the crushing and rolling was at the rate of \$500 per mile for roads ordinarily costing \$3,000 per mile. The farmers, moreover, secured good roads and cleared their fields of stone

at the same time.

An example of civic pride, rarely equalled, was shown in the little village of Friendship Heights, Maryland. When the Rockville pike, which passes through this place, was being resurfaced, it was proposed to use a somewhat cheaper surfacing through the village, because of lack of funds. The ladies of Friendship Heights, however, would not be satisfied with any surfacing which was not equal to the best to be found on the road. From the engineer in charge of the work on the road they ascertained the amount necessary to supply the deficiency, and at once set about to raise the funds by holding a bazaar. It is needless to say that the money was duly raised, and, thanks to the ladies, the village of Friendship Heights has as fine a road as any part of the Rockville pike.

A Commercial Club Assists.

In Hartington, Nebraska, the Commercial Club became convinced that one of the greatest needs of the region was good roads. During a considerable portion of the year some of the roads leading to the town became so bad that farmers were unable to come to town except on foot or horseback. There were thus long periods of duliness and little or no business ment was finally reached by the Board of Supervisors,

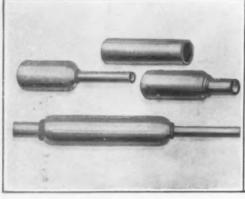
(Concluded on page 38.)



The engineer making the layout of what is intended to be a properly planned and constructed road.



Enthusiasm and misdirected labor a poor substitute for trained labor and skilled supervision.



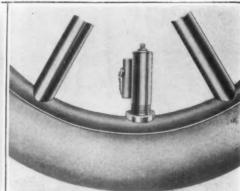
Sanitary drinking tube.

A compact quili-like device, made of aluminium, and containing a bone charcoal filter. When the two end parts are withdrawn from the cylinder and placed with the smaller tubes projecting outward a combination "drinking straw" and filter is formed, that lessens the danger and adds to the comfort of drinking from wayside streams.



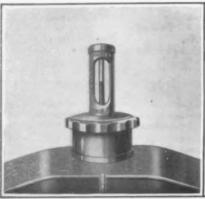
A universal cap.

This has a finted celluloid window that ordinarily folds up out of sight in the crown, but if you run into a cloud of dust bugs, cinders, or driving rain, with one hand the visor and window can be instantly pulled down to protect the face and eyes, while the sight is not interfered with in the least. The cap is made in a great variety of patterns for both men and women.



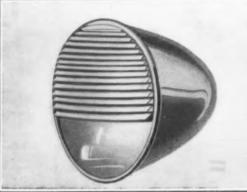
Low-pressure tire alarm.

A cylindrical device intended to be attached to the valve stem and provided with a whistle, which is automatically set in action as soon as the air pressure in the tire to which the alarm is attached, falls below a certain predetermined amount. A valve in the alarm enables the signal to be turned off if it is necessary to drive farther with the deflated tire before remains can be made



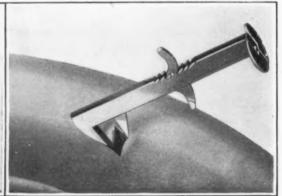
A check on overheating.

A long-stemmed thermometer, inclosed in a glass and nickel cylinder to insert in the radiator cap, so that the temperature of the cooling water may be seen by the driver without leaving his seat. The stem is of such length as to remain always in the water.



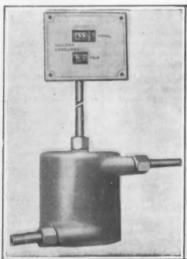
Deflector headlight glasses.

A headlight glass provided with horizontal corrugations is upper half, constituting prismatic lenses. These prism collect the greater part of the light, and direct it downwar and forward, increasing the illumination of the road; but allow enough diffused light to pass directly, to constitut a warning to those in front, without dazzling their eyes



A tire repair tool

An ingenious tool, consisting of one fixed and one movable jaw, th latter operated by means of two finger triggers acting in notche cut in the upper edge of the shank. By drawing on one trigger th space between the jaws is widened and a cut in a tire or tube may be spread apart and held in place while the cut is cleaned. A pressure on the other trigger releases the movable jaw.



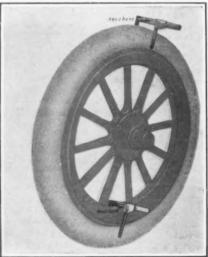
Measuring the fuel.

This is a compact meter to place on the dash that will accurately measure the fue consumed, regardless of speed of flow opressure. This enables the owner to checepones and waste.



A comfortable auto robe.

This heavy, woolen lap robe is provided with pockets in the bottom for protecting the feet of the occupants of the tonneau; and by means of properly arranged snaps the upper portion of the robe, which is in the form of an apron, can be drawn closely around the throats and shoulders of the occupants. This is made in both single and double widths, the latter having two pairs of foot pockets and two aprons.



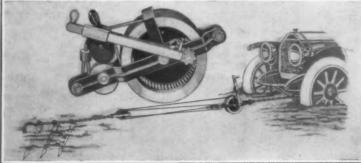
Tire caliper.

This instrument determines the amount of flattening of the tire at its point of contact with the road. The scales give the comparative diameter of the tire at point of greatest load, and at the point diametrically opposite.



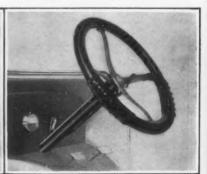
Pressure-reducing valve-

This is attached to an acetylene gas tank and furnishes the gas at a constant pressure to the burners, regardless of the tank pressure. The gas valve may be opened wide without the danger of a high flame at the lamps.



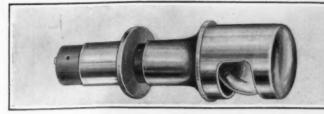
A rescue windlass.

This has an internally geared drum that is operated by a small pinion and a crank handle. The single block of a two-block tackle is combined with the winch. The fall of this tackle is wound on the drum, and this winch gear and tackle give a pull powerful enough to extricate an automobile from a mud hole, ditch, or other inconvenient position. The windlass is made fast to the axle of the automobile, and the double block of the tackle is anchored with stakes that will hold in almost any ground.



Warm wheel grips.

Thèse are electrically heated leather grips that are simply laced upon the steering wheel rim. They are operated either from a battery, lighting system, or generator, and require but little current. They insure warm hands, which helps avoid accidents. 15



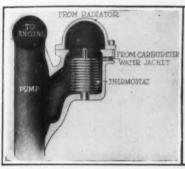
Combination dash and trouble lamp.

A "bayonet" socket in which an easily removed dash lamp may be placed. This furnishes a receptacle for one terminal of a long, flexible cord, into the other end of which the dash lamp may be inserted, thus forming a most convenient trouble lamp that will throw its rays to any desired part of the car. The shade on the dash lamp serves as a reflector for the rays of the trouble lamp.



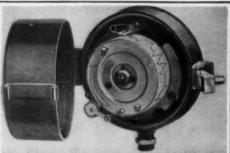
Lubricator for leaf springs.

A box-like device intended to be clamped to the sides of leaf springs to furnish lubrication for the surface. Squares of felt that line the sides of the box and that are pressed against the leaves of the spring serve as oil reservoirs from which the oil creeps by capillary attraction between the constantly moving surfaces of the leaves of the spring. The sectional view shows the construction clearly. The device may be applied with an ordinary screw-driver.



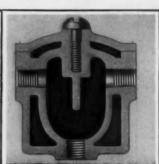
Thermostatic cooling-water regulator.

A valve actuating device controlled by the temperature of the jacket water. When the motor is first started the valve is closed; as the water becomes heated the thermostat expands and allows the passage or more water through the jackets.



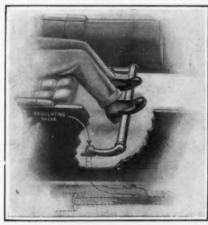
Log book for the motor vehicle.

An instrument which records time, distance, speed, and stops. It is adapted for motor trucks, to provide an absolute check at all times over the vehicle. The instrument has a star type of transmission, and is secured to the front wheel. Special means of attachment under the apparatus makes it tamper-proof.



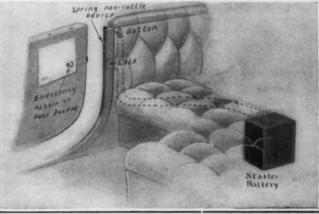
Fuel preheater connected with the exhaust.

A device intended to be installed in the fuel pipe near the carbureter, for preheating the fuel before its entrance to the float chamber. This device consists of an inner chamber, which is jacketed and surrounded by the exhaust gas. Thus the liquid fuel, rather than the atomized mixture, is heated, and the gasoline consequently changes to a gas the instant it is ejected through the needle valve. The two sectional views shown are taken at right angles to each other.



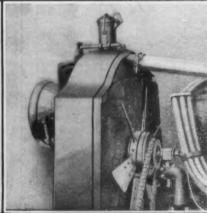
Ingenious foot warmer.

A hollow tube, similar to the foot-rail found in the tonneau of touring cars, is connected, by means of flexible plying, with the exhaust pipe of the car. A valve enables the occupants of the tonneau to admit the hot gases through the foot-rail, or to deflect them through the muffler.



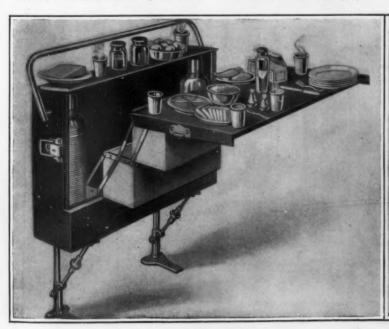
Electric door latch.

One of the recently designed light cars is provided with electric latches at each door. These are controlled by means of magnets excited by the storage battery used in the starting and lighting system of the car. The latches are held in place by springs and are released by the pressure of a button located in the side of the body, close to each door. A handle in the pocket on the door may be used in case of emergency.



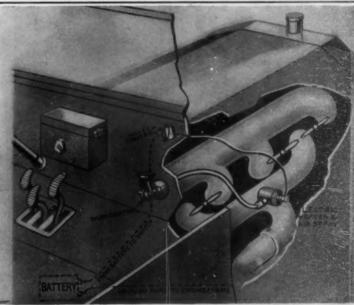
Combined fan and electric generator.

An electric generator combined in the bule of a radiator cooling fan. One portion of the bule serves as a stationary armature, while the revolving fields are carried by the fan. This generates direct current that may be used for churging batteries, for lighting and for lighting.



Motor lunch-case and table.

A compact lunch-case, not much larger than a suit-case, which may be attached to the motor car. When opened the front of the case forms a table on which the lunch may be served. Within the case are a vacuum bottle, and two compartments in which food may be kept ice cold or steaming hot for twenty-four hours. The case holds an ample lunch for six persons with all necessary table appointments.



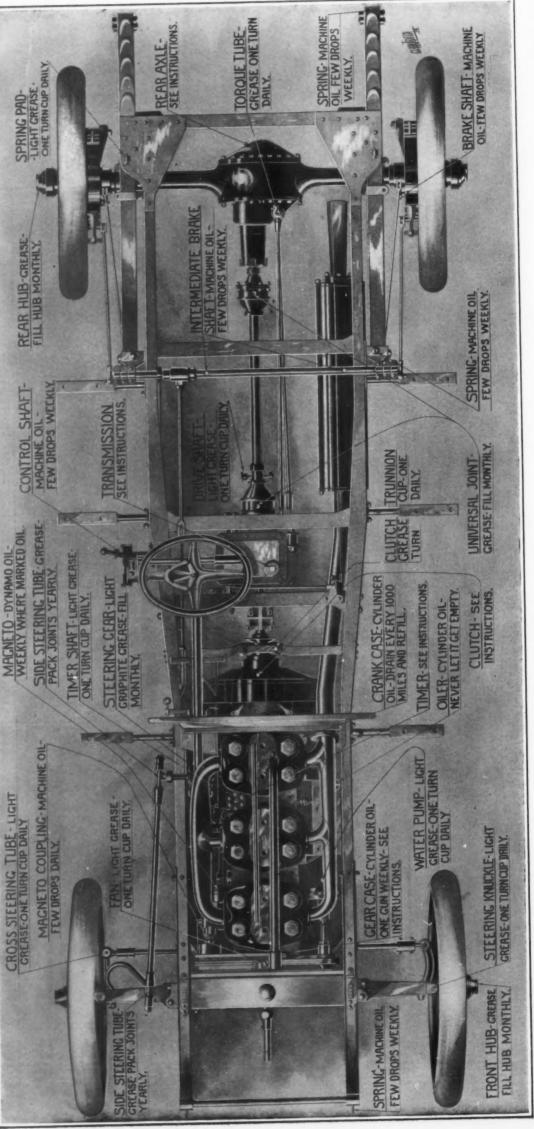
Electric primer and vaporizer.

From the priming cup on the dashboard a copper tube leads to a plug connected to a battery and inserted in the intake manifold of the engine. The gasoline from the priming cup passes through the plug, and it is not only sprayed, but actually boiled and vaporized, so that when the engine is cranked over it starts on the first turn over, just as easily, on a cold winter morning as on a summer day,

Chart Illustrating the Proper Lubrication of the Standard Motor Car Chassis

Instructions for the Systematic Oiling of All Important Parts of the Automobile Mechanism

Arranged by Victor W. Page, M. E., Author of "The Modern Gasoline Automobile"



pyright 1914 by The Norman W. Henley Pub. Co

SCIENTIFIC AMERICAN

Lubrication of the Motorcar Chassis* Explanation of Chart

THE plan view of a typical six-cylinder automobile chassis is depicted in the accompanying plate with all important bearing points requiring lubrication outlined. The construction of this chassis follows regular practice and it should be valuable as a guide to the correct lubrication of any car of modern design. While the arrangement of components will vary in the differ ent car types, most of the points indicated will be found in all automobiles and the directions given can be followed to advantage in caring for types other than that shown.

The importance of proper lubrication cannot be impressed too strongly on the minds of the average motorist or chauffeur. Any neglect in this essential means rapid depreciation of the machinery. Attention should be given to all minor points of the chassis periodically as lack of oil at what are usually considered points of minor importance means wear at a multiplicity of joints and noisy operation of the car even if the power plant, gearset, and rear axle are functioning perfectly. In the following instructions, endeavor is made the subject in a concise manner, giving the best kind of lubricant for the various bearing points, reasons for its use, and best methods of application. Where the parts different design require special grades of oil, this point is noted and proper grade recommended.

Engine Lubrication.

The best grade of oil to be used in the automobile agine depends upon a number of factors, such as power-plant type and condition, lubricating system used, and climatic conditions. The essential point to be observed is to select an oil of sufficient body and fire test to produce a film between all friction surfaces even when the parts become heated. The degree of fluidity must be suited to the system of supplying the oil to the working parts employed. Lighter bodied oil is needed in winter than in summer. The degree of wear between engine parts also governs oil selection to a degree, as a worn engine requires heavier bodied oil than one in which the bearing parts fit more closely

The proper oil for the lubricating system sho which consists of a mechanical force feed offer at the side of the engine crankcase with exposed pipes, must have a low cold test, that is, it must remain fluid at very low temperatures. In the systems where the oil supply is carried in a sump integral with engine crankcase and without sight feed glasses or exposed pipes, the lubricant need not be of low cold test, because all parts of the engine become heated enough to promote positive circulation of oil soon after the engine starts.

The use of too much oil will result in carbon deposits in cylinders and will be evidenced by clouds of white or gray smoke from the exhaust pipe when the engine raced. Not enough oil will produce overheating, as will oil that has not enough body. If an engine that has been run for a time is noisy, try a heavier oil if a light bodied oil has been used regularly. Air cooled engines require a heavier bodied oil than water cooled types do because they run hotter.

The following specification for light cylinder oil is recommended by the S. A. E.

Oil must be pure mineral oil, no addition or adul-erant of any kind being permitted. The following characteristics are desired:

Specific gravity..... Flash point, not less than . . 400° F. Fire test, not less than.... 450° F. Carbon residue, not over....0.50% (1/2 of 1%) Viscosity, at 100° F. Saybolt. 300 seconds Viscosity, at 210° F. Saybolt. 50 seconds

Use only cylinder oils recommended by the car maker or reputable manufacturer of lubricants. For new engines, oil of medium grade in body and clear, pale amber color will be found suitable.

Besides the cylinders and interior parts, there are a number of other points about an engine needing oiling. When the timing gears are housed in a casing distinct from the crankcase care should be taken to keep the supply uniform in this case as well. About one pint of oil will be enough, and cylinder oil of heavy body should be used. The starting crank bracket bearing should be oiled with an oil can, the pump shaft by screwing down the grease cups on the bearings. Mutton tallow and graphite are the best lubricants for this purpose. The fan bearings are usually of the ball type and the fan hub can be packed with light cup grease or vaseline at the beginning of each

Electrical Apparatus.

Special care is needed in oiling electrical apparatus. Only light spindle or sewing machine oil should be employed and then in small quantities. The timer, if of the platinum contact point type, needs lubrication only at the bearing points. If a roller contact type, use sewing machine oil sparingly in timer interior. Never use grease or graphite; the latter short-circuits the current, the former gums up and interferes with good contact between roller and segments. Avoid the use of machine or cylinder oil in magneto, generator, and starting motor bearings; use only light oil and a few drops at a time. If these bearings are oiled too frequently, windings on armature may become oil soaked. will result in short-circuiting. Avoid the use of oil in magneto contact breaker or distributor; these parts are intended to run without oil.

Clutch Lubrication.

A cone clutch requires lubrication only at three coints, these are the spigot bearing, the ball thrust, and the clutch release yoke or rolls. The spigot and ball thrust bearings are usually supplied with light grease through a grease cup. The release yoke and rolls are nearly always oiled by hand, using an oil can and machine oil. The cone clutch leather must be kept pliable with neats-foot or castor oil; never use cylinder oil for this purpose. Oil accumulations on the clutch leather will cause slipping; these must be washed off with kero ene or absorbed with borax or fuller's earth.

Three and five plate clutches operate practically the same as a cone clutch and are intended to be run dry except for the points noted above. Multiple-disk clutches having the driving members faced with as bestos friction fabric are also intended to operate with out oil between the friction surfaces.

Multiple-disk clutches using all metal plates are usually inclosed in an oil retaining casing. These are intended to run in an oil bath. Clutches of this pattern are usually lubricated by putting in oil through a filling plug, enough being used to almost touch the center shaft. A good lubricant for most disk clutches is a half and half mixture of light cylinder oil and kerosene. Special lubricant of the proper body for disk clutch oiling may be obtained on the open market.

Change Speed Gear Lubrication.

The most commonly used form of change speed gearing is the sliding gear type. The case is filled about half full with a semi-fluid grease or very heavy bodied steam engine cylinder oil. Avoid heavy greases; these will not properly lubricate the bearings and the revolv-ing gears will cut channels in the grease so that none will get between the teeth. The grease must be light enough to be churned about by the gears. Do not use greases filled with wood fibers or granulated cork will cause rapid depreciation of bearings

Planetary gearsets are seldom used on modern cars. That on the Ford is oiled by the lubricant employed in the engine interior and operates in an oil bath. Where the gearing is carried in a separate case, as in old type cars, use a very light semi-fluid grease, introducing the same with a syringe or oil gun through suitable filling openings normally closed by removable plugs.

Change speed gearing of the positive sliding clutch types with gears always in mesh, or those of the same pattern employing silent chains can be oiled by the same grease used in sliding gearsets. Friction disk forms use grease only at bearing points; no oil should be allowed to accumulate on the driving surfaces.

Rear Axle Lubrication.

The differential gearing of most axle types is housed in a casing that will retain oil. Where bevel gearing is used a grease of about the same grade as that advised for sliding gears may be introduced through a filling hole. Where worm gearing is used the grease should be fluid; it should be practically a heavy oil, espe cially if the worm is mounted above the worm gear. This is an important point to observe, as the oil mu be lifted by the worm gear teeth to the worm and its pporting bearings

Many commercial vehicles use chains for driving from a fackshaft to rear wheels revolving on a fixed axie. Chains must be oiled frequently and with care. The points subject to wear are the roll bearing and the link joint rivets. The best method to insure thorough lubricity of these points is to remove the chains from the sprockets, wash them thoroughly in gasoline or kerosene to remove all grit, and then to immerse them in a mixture of molten tallow and graphite. Hang up the chains, allow them to drain off, and then wipe off all surplus lubricant from the chain surface while that member is still hot. This process insures thorough pene-tration to the bearing points. Oiling the chain surface with an oil can is not sufficient, as this surface oil only collects grit.

All shaft drive cars use one or two universal joints. depending on the method of housing the pinion driving shaft. If this is carried in a torque tube but one joint is used, that at the upper end. Universal joints are usually encased and this casing may be filled with very On old pattern cars using open joints, leather bags should be made to lace around the joints, these being filled with light grease. These co the dual purpose of protecting the joint from grit and retain the lubricant as well.

Miscellaneous Chassis Points.

Wheel Bearings.—The anti-friction bearings used in both front and rear wheels are intended to be packed • Copyright, 1914, by the Norman W. Henley Pub. Co. 4 o with light grease and if the supply in the wheel hubs

is renewed several time each season no trouble will be Axle bearings of the roller experienced at this point. type are usually greased by small compression grease cups on the housing, as are torque tube bearings.

Springs.—The main points to lubricate on the suspen sion members are the spring shackle bolts. oiled with machine oil if provided with oil cups and with grease if compression cups are fitted. The spring seats on some rear axles are also fitted with cups to lubricants if these members are intended oscillate on the axle housings. Every season the springs should be taken apart, all rust removed from between the leaves and light grease and graphite smeared be-tween the leaves when the springs are reassembled.

Steering Gear .- The housing at the lower end of the column is usually provided with a filling plug through which cup grease may be introduced until gear housing A grease cup is often provided through which additional lubricant may be introduced. Oil must be squirted in between the column tube and steering post periodically, also on the spark and throttle control members if these pass through the steering post center. The ball joints on drag link and yoke bearings on the tie bar must be kept oiled or greased as the case may be. The compression cups on the steering knuckle bolts must also be screwed down periodically.

Control Members.—The hand levers for shifting gears and applying the emergency brakes and the clutch and brake pedals are located on concentric shafts in some cars and these shaft bearings must be olied by a hand oil can in most cases. The small rod end pins on brake rods and bearings on the axle supporting the brake control shafts also demand frequent attention with the hand oil can.

Draining Off Used Lubricant.—As any oil or gre used, it gradually depreciates in value as a lubricant. The oil used in constant level splash systems of engine lubrication becomes impregnated with carbonaceous matter and metal dust due to attrition of the bearings and other internal parts. That used in gearsets may contain small metal particles chipped off of the gears when these are clashed in shifting and the oil in the differential housing also becomes dirty as used. In other words, oil may "wear out" and become unsuitable as a lubricant when used continuously. Most engine builders recommend thoroughly draining out the engine crankcase every 1,000 miles, washing out all sediment with kerosene, and replenishing the supply with clean, new oil. The smallest automobile engine crankcase will need about a gallon to refill, those of larger engines may require two or three gallons.

A multiple-disk clutch case should be cleaned out frequently, usually as often as the engine receives atten-Gearboxes and rear axles should be wash every 2,000 miles and new clean lubricant used in refilling. Where grease cups are employed the new grease forces out the old lubricant, as the cup is screwed down so a constant supply of clean grease is insured. Similarly, those points lubricated with fluid oils are supplied with clean oil from the hand oil can as the use leaks out gradually from between the surfaces. Keep all surfaces exposed to the dust wiped clean of lubri-cant, as this serves no useful purpose, merely attracting road grit. Keep all oil and grease from the tires, rub-ber hose connections of the cooling system and insulation of the ignition wires, because lubricants have a soluble action on rubber or compounds containing that material.

Preserve Your Papers: They Are of Permanent Value

Y taking a little trouble, when a paper first comes By taking a little trouble, which to hand, it may be preserved to form a permanent and valuable addition to the reading matter with which everyone should be supplied. We furnish a neat and attractive cloth board binder, which will be sent by mail, prepaid, for \$1.50. It has good strong covers, on which the name Scientific American or Scientific AMERICAN SUPPLEMENT as stamped in gold, and means by which the numbers may be securely held as in a ound book. One binder may thus be made service able for several years, and when the successive volumes, as they are completed, are bound in permanent form, the subscriber ultimately finds himself, for a moderate cost, in possession of a most valuable addition to any library, embracing a wide variety of scientific and general information, and timely and original illustrations. Save your papers.

The Zodiacal Light.-According to Fessenkoff, it is impossible, in view of the discordances existing between the facts announced by different observers (Bayldon, Marchand, Tupman) to fix in any precise manner the position of the band of zodiacal light. New observations are necessary and Birkeland proposes to pursue them for a period of three years at Natal and elsewhere, including Uganda. His object is to test his hypothesis relative to the emission of radiant matter and electrons by the sun. In his opinion these corpuseles group themselves around the sun's magnetic equator.



War Experiences of an Air Scout—II*

The Patrol of the Sky

By Frederick C. Hild, American Volunteer With the French Aviation Corps

onoplane flying, I requested the captain to let me

tain that, as I was now in the Rep school I could fly that machine only, and that, therefore, this would be

I received permission, but was told by the cap-

THE next morning a bugle aroused us at 6:30, and after a hasty toilet in a cold stream that runs close by I was ready for roll call. This roll call is held at 7 o'clock every morning, and as absence from this means four days in jail I always managed to be present. Saluting superior officers was another hard-ship, and after several "call-downs" I was able finally to salute every officer I met as well as the two-year experienced and trained soldier.

After roll call we went to breakfast. This consisted of a cup of black coffee and hard dry bread. How the French government expects us to fly on such fare is beyond me. I went to the home of some peasants in the vicinity, and for a few cents I obtained a large bowl of hot chocolate, with bread and butter. This I did every morning.

I was not given an opportunity to fly for several days I was informed that I must wait until a new machine was completed. It is a rule that all new arrivals must make their first flight on a machine of only 50 horse I found there was an oversupply of French mechanicians, there being about five to each machine. I wondered why there were so many until I saw the way they worked, and then I wondered no more. good American mechanic can do more work in a day than five of them in a we

The First Test in the Air.
My friend, Fileux, who was among the pilots, and I passed our first tests successfully, but the man (Corporal Delmas) who was tried out after us, wrecked the machine, which was a 50 horse-power Gnome-motored, Blériot monoplane, and caused us further delay.

I was beginning to get disgusted with the slownes French military system; therefore, I best Capt. Duperron, through an interpreter, for some action, and was henceforth transferred to the "Rep"

plane, a machine that easily makes 90 miles The Rep monoplane, equipped with an 80 horse-power Gnome motor, is quite a heavy apparatus, constructed mo ly of steel, and in workmanship and materials it represents the best French aero nautical construction that I have seen.

A Member of the "Rep" School. My opportunity to fly came the next ay, and for the first time I enjoyed a flight of 30 minutes, which took me 2,000 meters (6,500 feet) high and gave me an opportunity to see the country about me, urs is indeed a beautiful city. day being a clear one, I could see the country for miles about; chateaux showed themselves here and there, and I should have liked to continue my flight, but, being permitted to fly for only a half hour,

was obliged to come down.

My friend, Fileux, seeing my suc also inquired of the captain for permission to be transferred to the Rep monoplane; and sad to say his first venture wound up disastrously, owing, perhaps, to his getting excited by the tremendous speed. He pulled back the elevating lever several inches, to rise, when he should have pulled it back about half an inch, and as a result, the machine shot straight up into the air for about thirty feet and then fell upon its side and nose like a wounded bird, completely smashing the apparatus, and, poor fellow, he is in the hospital, where he will be laid up for about a month, his right eye being hurt and his knees badly injured.

A Collision Narrowly Averted. The following day, not having a

chine to fly, and seeing a new Blériot

my last flight on the Blériot. I flew for 45 minutes and enjoyed it immensely, though I narrowly escaped death by collision in the air with a Nieuport monoplane. My machine was flying horizontally at an altitude of about 1,500 feet, when directly above me a pilot in a Nieuport was spiraling from a height of 5,000 feet, and coming directly toward me. I tried to steer out of its path, but he kept on coming toward me, and for moment it appeared impossible to avert a collision I attempted to dive, but had it not been for the fact that he peered out of the machine in my direction, nothing in the world would have saved me, since the speed of his machine doubled that of mine, and it was only by his immediate jerking of the elevating control toward him that he saved the situation. His machine was so close that the tail of his machine seemed to graze that of my machine, and the sudden rush of disturbed air was so violent that I had the greatest difficulty in keeping my apparatus from capsizing.

I remember only one other incident in my four years

of flying where I was so close to death: this occurred the day of the baby parade at Asbury Park a year ago when, with my apparatus directly over the parade, my motor stopped, and I crashed through the branches of a large tree near the baseball park, from which point I had started my flight.

The next morning a new arrival to the Second Avia tion Reserve at Tours did the same to the Blériot monoplane I had flown the day before as my friend This made the third machine I had flown at Tours that was completely demolished the next day. This poor chap, though unhurt, is now serv-

ing a thirty-day term in jail, as it was learned that he had never been in a machine before in his life.

Qualifying for Pilot.
Two days later, Friday, October 9th, proved an eventful day for me. A new 80 horse-power Rep monoplane had arrived, and I was given permission to fly it. did so for twenty minutes, and then I was given permission to qualify for my military brevet. The recording barometer was secured and fastened to the machine mechanics, but after flying for five minutes it worked loose, and I was forced to descend for a fresh start—an example of the work done by the French mechanics. This time it was fastened more securely. arose to a height of 2,500 meters (8,200 feet) in twenty minutes, and then straightened out my machine to remain there for one hour or more; but alas! after flying for thirty minutes at this altitude, the barometer refused to operate, and I had to descend

I made a fresh start at three o'clock in the afternoon. This time I fastened the barograph myself, by a cord around my neck, the barograph resting against my chest, to which I had fastened a mirror in order to note its operation while in flight. A small aneroid, stationary part of the machine, capable of registering 3,000 meters, acted as a guide when once I attained the height of 2,000 meters.

I bundled up good and warm with safety helmet, goggles, sweater, leather coat, and gloves. I flew for one hour and forty-five minutes, one hour and fifteen minutes of this at the height of 2,200 meters The barometer worked perfectly, and I had flown all over the neighboring country, which consisted of large dense woods, rivers Share and Loire, large cities and small towns, and I certainly enjoyed my stay to the air at this altitude, although it was terribly cold, and I was really glad to descend once again to Mother Earth. The recording barometer

having worked satisfactorily, I was given my military license by the military officials, who congratulated me upon being the first and only American licensed aviator to fulfill the test. I now await the arrival of the brevet from the Minister of War and the Director of Aeronautics, both of whose approvals I must have before it is issued, since upon its receipt I am ready to be sent to the front. I was informed by the captain that he had received instructions from headquarters that four licensed Rep monoplane pilots were wanted in a few days to pilot machines to the front; so I was rather pleased to have obtained my license, as I was tired of wasting valuable time when I could be accomplishing something and be of e use to France.

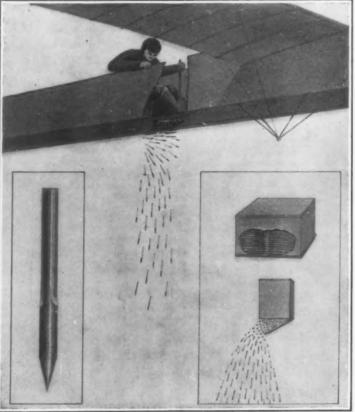
Machines Discarded by the French

Government.
Three days after having qualified for my military brevet, an important order was issued by the Director of Aeronautics, which affected a great many pilots and demonstrated the inefficiency of certain

apparatus. The order ran as follows: In future there shall be no more Blériot, Rep, Nieuport, or Deperdussin monoplanes used by the French government, and all those pilots learning or now operating any of these machines must immediately change to either of the following apparatus: Morane-Saulner monoplane, Henry Farman biplane, Maurice Farman biplane. Caudron biplane, or the Voissan biplane.

I immediately changed to the Morane-Saulner monoplane, a smaller machine in comparison to the Rep monoplane, but con-

(Concluded on page 38.)



How steel darts are dropped from an aeroplane.

lusert on the left shows a dart about half size; on the right, the box from which they

* Copyright, 1915, by Munn & Co., Inc.

SCIENTIFIC AMERICAN

American Automobile Coachwork

Criticism of Domestic and Foreign Car Bodies

By John Jay Ide

THE bodies of American motor cars produced for the season of 1914 exhibited a noteworthy advance over those of the preceding season. A certain number of manufacturers realized that they could learn something from foreign design with

the result that not a few cars boasted hoods tapering into the cowis, giving the proud designer the opportunity of calling the child of his brain "a true streamline proud designer the opportunity of caning the child of his brain a true streamline production." Even where no transition between hood and dash was attempted, that typical American institution—the windshield with massive brass stay rods, which

rendered the engine so difficult of access—was in many cases replaced by one fast-ened securely enough to the cowl to need no external bracing. In a very few cases the one-man top fastening onto the windshield was adopted, thus rendering unneces-sary another eyesore: the straps connecting the front of the top with the frame or

mudguards as the case might be.

For 1915 these tendencies find wider expression, and it is now the exception

rather than the rule to see a new model offending in the above respects. A few makers have copied a certain Belgian car in supplying pointed radiators. A greater number have followed the lead of a certain French "marque" of racing fame in rounding off the radiator top, thus eliminating the hard edge.

In most of the cheaper cars sidelights have ceased to exist on the claim that they interfere with the streamline effect. A dimmer attachment in the headlamps

is substituted for them. Most of the higher priced cars, however, retain sidelights either in combination with the headlights or in their accustomed place at the dash.

Many makers advertise "crowned" mudguards; a few have gone further and have adopted domed guards. The latter is certainly the final type, but stress should be laid upon the desirability of having the valance and mudguard in one piece. This not only eliminates a possible source of squeaking, but greatly improves

Most of our designers have not yet learned to make the rear fenders follow the curve of the wheels. Beginning too near the tire on account of the presence of the door, the mudguard steadily diverges therefrom until at its rear end it is

often as much as 9 inches away. It may be urged that this is done to allow for depression caused by weighty passengers in the rear seat. As a matter of fact the depression is barely perceptible in the most heavily laden cars owing to the stiffness

Both front and rear fenders would be much more efficient if they were brought

closer to their respective wheels. After all, only sufficient space is needed to allow for the spring compression on the wheel's striking an obstacle. There is much to

be said in this respect for the mudguards attached to the stub-axles and following the vertical movements of the wheels. These have been tried both here and abroad,

but difficulty has been experienced in attaching them securely. Surely this can

a number of years. Another inconvenience has also happily been removed. That was the gap between the top of the windshield and the front of the top, often just

was the gap between the top of the windsheld and the front of the top, often just large enough to allow the rain to drift in and wet the occupants.

A number of makers now inclose the top completely when down, not even allowing the bows to peep out of their housing. This is one step toward the incorporation of the top in the body, credit for which must be given to a noted Berlin coach-

maker who exhibited a remarkable body at the European shows in November, 1912. As shown in Fig. 1 the lines of the top casing are very agreeably led off into the

sections. The general appearance is very pleasing indeed, but it is difficult to imagine anything not superior to the ordinary top when folded down.

lights are placed on the mudguards, where they fulfill their true function of indicating the real width of the vehicle. The divided rear seats are of the adjustable

Pullman type. Behind the front seats is a cowl protecting a cupboard with several

drawers. It will be seen that no upholstery protrudes above the body sides. The round hole adjacent to the levers is the gauze covered horn orifice. Except for the

external levers and the mudguards this body is still in advance of current touring

Fig. 2 represents the latest model of the same firm. As in the previous body can hardly detect the rear end of the hood. When it is desired to light the

headlamps the front sections are removed and clipped upon the rear portions.

A German sporting model is shown in Fig. 3. Rather than mold the bonnet to

suit the body the designer has forced the latter into an ugly form. The windshield is interesting as the glass of the stationary portion is cut to fit the bonnet curve,

there being no filler board. The external exhaust trunk, elementary mudguards,

disk wheels and pointed radiator are in keeping with the character of the The French berline in Fig. 4 has an overall height of slightly less than six feet.

This body might be studied with advantage by the makers of some of our ponderous eight-foot chariots. Although of the single-compartment type it has a separate entrance for the front seats, a solution not without certain advantages. Sufficient

headroom is obtained for the rear seats by sinking the floor below the chassis level.

To England must go the credit for developing the cabriolet, an example of which

on page 40.)

Apart from the top casing the body has many points of originality.

When out of use the top is completely boxed in by three detachable

As remarked above, one-man tops have become general, so that entrance front seats is no longer blocked by the bows. The obstruction caused by the bows was one of the greatest defects of the old-fashioned top, and it is astonishing that the one-man type was not adopted here before 1914, as it has been used in England

the appearance of the car.



Fig. 1.-Top snugly housed.

Fig. 2.—Streamline headlights,





h

to

er

rd ny to

d.

he

ad ege.

ay oly

to ter

offi-

vi-

ter

be

vas

hat ere

red

of

h

for

and

riot.

ines all

tely opa-

ane e in







Fig. 7.—American touring body.



Fig. 8.-Rather inelegant design.





Fig. 10.—Clean cut berline.

Fig. 11 .- A novel sedan.



Fig. 12.—A pleasing limousine.



Fig. 13.-Shows broken lines.



Fig. 14.—Symmetrical touring body.



Fig. 15.—Boat type body.

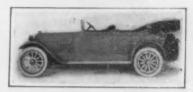


Fig. 16.—Too many moldings.



Fig. 17.-An unsuccessful design.



Fig. 18 .- A fine sedan.

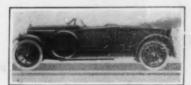


Fig. 19.—Handsome American tourist.



Fig. 20.-Has too low a side



Fig. 21.-Rather low-sided.



Fig. 22.—A sedan design of 1912.



Fig. 4.-A French berline.



Fig. 5.—An English cabriolet.

Fig. 6.-English town car.





car design.

Over 3,000 Dealers anxious to shift to—





The Heavens in January

Weighing and Measuring a Star 200 Light Years Distant from the Earth

By Henry Norris Russell, Ph.D.

THE distances of many of the stars are now fairly well known; their real brightness compared with that of the Sun may frequently be calculated; we know the densities of about ninety stars and the masses of a rather smaller number. But there are very few a rather smaller number. But there are very few cases in which the actual size of a star—its diameter in miles—can be determined, and, therefore, a new instance of the sort well deserves discussion here

The star in question, known as RX Herculis, is of the seventh magnitude and quite invisible to the unaided eye. As its designation indicates to the initiated, it is variable in brightness, and the fact that we can determine its actual size adds to the discerning mind the information that the variability must be due to eclipse and that it must have been observed with the

Attention was first called to this star when it was found that it lost about 40 per cent of its light at intervals of 21 hours 20 minutes and 34 seconds, remaining constant in brightness for all but about 5 hours of this interval. This behavior showed at once

that the loss of light must be due to an eclipse by some attendant body, as in so many other cases

Frost at the Yerkes observatory showed that the lines in the spectrum became double in the interval between eclipses, and thus proved that the compani well as the principal star was bright, so that their spectra appeared simultaneo ly when one was rushing toward us after it had been eclipsed, and the other receding. Long series of accurate measures of the brightness of this star have been made at Harvard by the late Prof. Wendell, and at Princeton by Dr. Shapley (now of Mount Wilson stuff), by whom the calculations here described have been carried

These two sets of measures agre feetly, and show that, outside the eclips there is not the least variation in light. Successive eclipses, however, are slightly unequal in magnitude, the maximum ob servation being alternately 40.8 and 35.7 per cent of the light at maximum. This small difference is demonstrated beyond question by the observations. Its explanation is fairly obvious. The two stars, which revolve around one another, are slightly unequal in brightness. One gives little more light per square than the other, and so when the former is eclipsed a little more light is lost than in the opposite case. As the stars circle each in turn partially eclipses the other,

and the observed situation follows. The actual period of revolution must then be double that between eclipses, or 1 day 18 hours 41 minutes 8.79 seconds, according to Dr. Shapley. As the time of the middle of eclipse can be determined within a very few minutes, and it has been under observation for fourteen years, or nearly 3,000 revolutions of the system, it is clear that this value can be at most a couple of hundredths of a second out of the way.

The orbits in which these two stars move about their iter of gravity must be practically circular; for the shallower eclipses come just half way between the es and last equally long, and if the orbit was eccentric this could not be the case.

So much has now been found out about this system by very simple reasoning that it is not surprising that a great deal more can be discovered by calculation based on the photometric observations (which give the and brightness of the stars) and the spectroscopic data (which give the actual size of the orbit, and hence of the stars, in miles). We may, therefore, pass to Dr. Shapley's summary of his conclusions,

which is substantially as follows: The system of RX Herculis consists of two stars of equal mass and nearly equal brightness, which revolve about their common center of gravity in circular orbits of equal size at distances of 1,620,000 miles on opposite sides of the center, or 3,240,000 miles from one another, completing a revolution in 1 day 18 hours 41 minutes, as aforesaid.

The plane of this orbit makes an angle of only 4 degrees with the line of sight from us to the star, so that each star eclipses the other once in every revolu-

The larger star, 1,300,000 miles in diameter, does not shine quite so brightly per square mile as the smaller, so that the latter, though but 1,170,000 miles in diameter, gives out eleven twelfths as much light as the other. When the smaller star goes behind the larger only a thin crescent of about one seventh the width of the whole disk remains in sight. This gives the principal (deeper) eclipse. When the small star comes in front of the larger, we get the secondary and shallower eclipse.

The mass of each star is 89 per cent of that of the Sun (unusually small for a white star like this), and the density of the larger one is one quarter, and that of the smaller one third of the Sun's density.

If the stars give off as much light per square mile does the Sun their distance from us must be such that light would take 200 years to travel it. But the spectrum of the stars closely resembles that of Sirius or Vega, and it is very probable that stars of this sort are much hotter (at least on the surface) than the Sun, and shine far more brightly—giving out from north one may, on the brilliant nights of winter, see at their best the nebula of Andromeda and the great star cluster in Perseus (between this constellation and Cassiopeia) and then facing about, compare these with Praesepe in Cancer—a cluster which, unlike that in Perseus, is resolvable into its component stars in a

From the very appearance of this cluster one would judge that it was nearer than the other, and this is probably true—though if Schwarzschild's estimate of 500 light years for its distance be correct, as seems very likely, it is hardly what even an astronomer would ordinarily call a neighboring object. Kapteyn, in the case of the Perseus cluster, concludes that it is probably 1,600 light years off at the least, and perhaps very much farther.

As for the Andromeda nebula, hardly anyone would dare even to guess at its distance, but as its spectrum resembles that of a star cluster, and no separate stars can be seen, even with the greatest telescopes, it may be vastly more distant still. Turning back to the east, Turning back to the east,

we find Leo well above the horizon, and Ursa Major coming up on the northeast; and the familiar constellations about the pole complete our survey.

The Planets.

Mercury is practically invisible at the beginning of the year, but comes out into the evening sky, and by the end of Janu ary is well visible, setting at 6:30 P. M. By the end of the month he is close to Jupiter, and the two form a pretty pair, Jupiter appearing about twice as bright as Mercury.

Venus is morning star, and at her greatest brilliancy as the year opens-twelve times brighter than Jupiter. She rises at 4 A. M. or a little after all through the onth, and is the glory of the morning

Mars, having just passed conjunction with the Sun, is theoretically a morning star and practically invisible.

Jupiter is evening star in Capricornus and visible now only in the early evening. Saturn is in Gemini, just past opposition and a splendid object both to the eye and telescope. He is so bright that he quite changes the appearance of even the bril-liant region of the heavens through which

he is passing.

Uranus is so low in the west at sundown as to be unobservable. Neptune, on the other hand, is in opposition on the 19th, and favorably placed. On December 31st his right ascension is 8 hours 6 minutes 46 seconds and his declination, 19 degrees 52 minutes north. On February 1st these co-ordinates have become 8 hours

3 minutes 5 seconds, 20 degrees 4 minutes north. This puts him about 8 degrees west of Praesepe and 2 degrees north of the fine triple star ζ Cancri—where the observer who has a three-inch telescope and a star-chart, or the patience to make one for himself, may find him.

The Moon is full at 7 A. M. on the 1st, in her last quarter at 4 P. M. on the 8th, new at 10 A. M. on the 15th, in her first quarter at 1 A. M. on the 23rd, and full again at 11 P. M. on the 30th. She is nearest the Earth on the 12th, and farthest away on the 24th. passes near Venus on the 12th, Mars on the 14th, Mercury on the 15th, Uranus on the 16th, Jupiter on the 17th, Saturn on the 27th, and Neptune on the 30th.

Princeton University Observatory.

At 916 o'clock: January 29. NIGHT SKY: JANUARY AND FEBRUARY

six to ten times as much light per square mile. On this basis, therefore, the distance of the system may be estimated as 500 light years (or thirty million times the distance of the Sun), and the light emission of the pair as fully thirty times that of the center of our system. If this be true the eclipses recently observed actually took place long before Columbus discovered the New World, and more than ten thousand other eclipses of each star by the other have happened since, and are, so to speak, on their way to us-the light which will announce them being still far in the depths of interstellar space.

It is really amazing that, by means of observations which, if a full account was kept of the time taken, would aggregate less than a month's work by one observer, so much information about the nature of a star at so immense a distance can be obtained.

The Heavens.

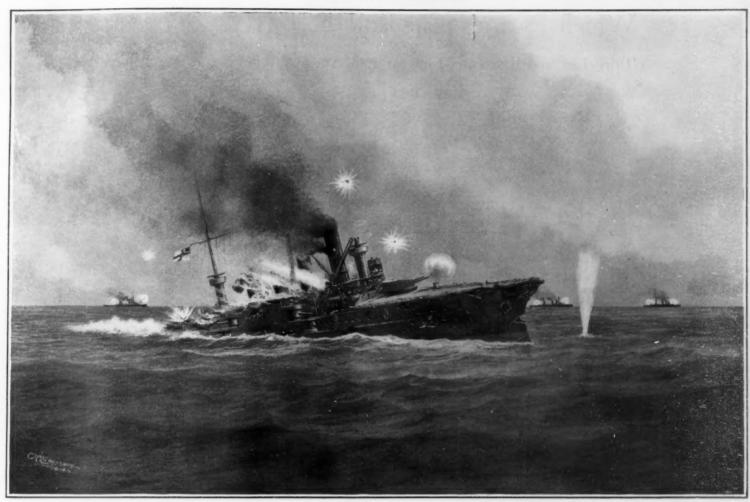
The southern sky now displays its full splendor.

Orion marches proudly across the meridian, confronting the Bull with upraised arms, while the Great and Little Dogs follow their master, and we may, if we will, imagine that the Little Hare and the Dove are escaping for dear life. But we cannot carry our mythological picture much farther without getting into a helpless jumble of ships and sea serpents and crabs and twin babies; so it may be well to return from the constellations to the stars.

In the dull southwestern sky we may note our near δ and ϵ Eridani and τ Ceti, and the famous variable Omicron Ceti (Mira) now rapidly rising toward maximum. Farther to the right and west of

Shipping Eggs by Parcel Post

THIS is a subject in which both the Post Office Department and the Department of Agriculture have, of late, been greatly interested. During the period October, 1913-February, 1914, the Office of Markets carried out a thorough test, consisting of no less than 466 shipments, aggregating 761 dozen eggs, sent over various distances, under various conditions, and in various types of containers. Some of the longest shipments were between Washington and Minneapolis and etween Washington and the Rocky Mountains. total breakage was 327 eggs, of which only 209 were broken beyond use, and of these 91 were broken because the parcels containing them were not handled in accordance with postal regulations. Subtracting these, the loss was less than 1.3 per cent.



The "Scharnhorst" going down at the close of the engagement, off the Falkland Islands, with Admiral von Spee's flag at the main yard.

The Sinking of the German Pacific Squadron

Superior Speed and the Long-Range Guns Win a Running Fight

By piecing together the many cabled accounts of the late British-German cruiser action off the Falkland Islands in the South Atlantic, we are able to gather a fairly accurate impression of that highly dramatic sea fight. The encounter marked the successful end of a search for the German ships undertaken by Vice-Admiral Sturdee with the battle-cruisers "Invincible" and "Inflexible" and a group of five smaller vessels.

As will be seen from the enumeration given below, the British squadron possessed a superiority in armorpiercing guns and armor as overwhelming as that which enabled Von Spee to crush the British squadron under Cradock a few weeks before.

The British fleet consisted of the battle-cruisers "In-

The British fleet consisted of the battle-cruisers "Invincible" and "Inflexible," the armored cruisers "Carnarvon," "Cornwall" and "Kent," and the scout-cruisers "Bristol" and "Glasgow." In the German fleet were the armored cruisers "Scharnhorst" and "Gneisenau," the protected cruiser "Leipzig," and the two fast scout-cruisers "Nurnberg" and "Dresden."

When last heard from, Von Spee's squadron, after coaling at Valparaiso, had steamed south. Apparently his objective was the British coaling station at Port Stanley in the Falkland Islands; and a rumor (to which too much credence should not be given) has it that the converted cruiser "Prinz Eitel Friederich," with troops on board for the occupation of the station, accompanied the squadron.

Be that as it may, on the morning of December 8th the "Canopus," an old battleship with 6-inch armor and 35-caliber guns, and the British armored cruisers and scouts, which were cruising outside the

land-locked bay on which Port Stanley is located, saw the German squadron lifting above the horizon. The two British battle-cruisers were inside, coaling, and according to dispatches were not visible to Von Spee. To the German admiral it looked like an even fight, for, although it was six ships to five, there was no vessel in the British force that could match the "Scharnhorst" and "Gnelsenau." So down he drove, with ships cleared for action. Von Spee's flagship, the "Scharnhorst," was the gold medal ship for gunnery in the German navy, and it was her 8.2-inch salvos that had contributed mainly to the sinking of the "Good Hope" and "Monmouth."

The fight was no sooner well under way, we are told, than out of Port Stanley steamed the two battle-cruisers. They took on the "Scharnhorst" and "Gneisenau" and left the smaller ships to fight it out among themselves. Von Spee signaled his fleet to scatter, and himself ranged up for the last, bravely-fought battle of his life.

It would be very interesting to know at what range the fight between these four ships was fought. Theoretically, Admiral Sturdee, having the more powerful gun and the higher speed, should have fought just outside the range at which the 8.2-inch shells of the Germans could land with serious effect. Judging from the fact that the action lasted from 1 P. M. to 6 P. M. and that the total casualties in the whole British fleet were only nine killed and a few wounded, it is probable that Sturdee, having the speed gage, fought at an extreme range, probably 12,000 to 14,000 yards, being content to sink the German ships gradually with a minimum loss of his own personnel.

The Germans fought it out with characteristic courage to the very end, the "Scharnhorst" going down by the stern, with the admiral's flag flying from the main yard. The "Gneisenau" went under a little later; and after a spirited action the "Glasgow," which was in the Chilean fight, sunk the "Leipzig." Subsequently the "Nurnberg" was overtaken and sent to the bottom. The "Dresden" escaped and is still at large.

A New Cement Product

It is likely that South Germany will furnish a supply of trass for cement making that promises to be of value. It has recently been found that the volcanic tufa which makes up the subsoil between Bischingen and Tapfhelm is quite superior to the trass of the Rhine region. The new trass of the Danube, however, presents, in the usual method of cement mixing (1 part each of trass, lime and sand with water), an excellent resistance to strains, and the qualities of the trass mortar will allow it to replace cement mortar, the cost of which is 50 per cent higher. Such mortar is slower in hardening than cement mortar, but on the other hand is said to be more elastic, stronger, and less porous. Besides, it is rare that such mortar, when well prepared, will show cracks as in the usual cases. It can be worked as well in very cold weather as at other temperatures, so that it can be used throughout the winter. When in the powdered state, trass does not suffer from dampness, and is not deteriorated by lying in storehouse for long periods. Another point is that 100 parts of it give as much mortar as 150 parts of cement. The operating of the trass quarries in south Germany promises to be a good venture, for there is no doubt among competent authorities that ordinary cements can be replaced by this material.

Federal Aid for Good Roads.—The American Road Congress, recently held at Atlanta, endorsed the principle of Federal co-operation toward the construction of main highways in the several States, and the Government was urged to construct roads across all Indian reservations, forest reservations and other federalized areas where such connecting links are essential parts of through routes of travel. Uniform road legislation was urged on all States, as well as the passage of road laws in those States as have not yet done so.

BRITISH SQUADRON

	BRIT	isn squ	ADRON.			
Name.	Type.	Type. Date. Displace		Belt armor.	Guns.	Speed.
"Inflexible" "Carnarvon" "Cornwall" "Kent" "Bristol" "Glasgow"	Battle Cruiser Battle Cruiser Armored Cruiser Armored Cruiser Armored Cruiser Scout Cruiser Scout Cruiser Scout Cruiser Scout Cruiser	1908 1908 1904 1901 1903 1911 1911 1897	17,250 tons 17,250 tons 10,850 tons 9,800 tons 9,800 tons 4,800 tons 4,800 tons 12,950 tons	7-inch 7-inch 6-inch 4-inch 4-inch none none 6-inch	8-12",16-4" 8-12" 16-4" 4-7.5", 6-8" 14-6" 14-6" 2-6", 10-4" 2-6", 10-4" 4-35 cal. 12", 12-6"	26.5 26.5 23.0 23.5 23.0 26.5 26.5 16.5
	GERM	MAN SQU	ADRON.			
"Gneisenau" "Leipzig" "Nurnberg"	Armored Cruiser	1907 1907 1906 1908 1908	11,600 tons 11,600 tons 3,250 tons 3,450 tons 3,600 tons	6-inch 6-inch none none none	8-8.2", 6-6" 8-8.2", 6-6" 10-4" 10-4"	23.5 23.5 23.0 24.0 24.0

Which Pleasure Car Fits the Buyer's Purse?

A Price List and Reference Table of 1915 American Gasoline Pleasure Cars

Compiled by C. Edward Palmer

DURING the past year or two the trend in automobile design has been toward the refinement of details, the strengthening of weak points, and simplification of operation.

Except in a few specific instances, no marked changes in design have been made, although many manufacturers have amplified body construction and added features have and there, which have made for luxury, both for passengers and driver. Whereas, three or four seasons ago, the electric starting and lighting system attracted much attention at the automobile shows, this year it is supplied as regular equipment on more than 90 per cent of the cars manufactured in this country.

For the average prospective purchaser, the problem of buying a car has narrowed down to the question, "Which car fits my purse?" Within the range of price he can pay, the customer will find a large number of cars to select from. It is with the object of assisting such visitors at the automobile shows or salesrooms that the following

Except for the abbreviations used, the table is self-explanatory. In each price column the first figure indicates the number of cylinders, while the second gives the rated horse-power. The small letters refer to the type of body which may be obtained with that particular chassis at the price indicated, while the capital letters tell whether the car is equipped with self-starter and electric lights. Thus, r means roadster body; t, touring car; c, coupé; s, sedan; p, phacton; b, berline; l, limousine, and

adautet. S indicates self-starter, and E, electric lights.

While the table does not include every car manufactured in the country, nor does it include all companies making only a few cars per year, it does give the more important and representative models of the companies listed. Where further information is desired, manufacturers will supply catalogues, detailed specifications, etc., on

Name of Car	Name and Address of Manufacturer	Under \$700	\$700 to \$1,200	\$1,201 to \$2,000	\$2,001 to \$3,000	\$3,001 to \$4,000	Over \$4,000
Abbott-Detroit	Abbott Motor Car Co., Detroit, Mich *	111	4 35 c C P 4000	4. 40, r,t,S,E, \$1,875. 4. 40, r,t,S,E, \$1,395.	6, 60, r,t,S,E, \$2,290.	6, 60, <i>l,S,E</i> , \$3,500	
Alien	Allen Motor Co., Fostoria, O., Alter Motor Car Co., Plymouth, Mich.	4, 27, r,t,S,E, \$685.	4, 35, r.t.S.E. \$895.				
Ames	Ames Motor Car Co., Owensboro, Ky			4. 27. r.t.S.E. \$1,785.	6. 50, r.t.S.E. \$2,500		
L. E. C	Auger Eng. Co., Milwaukee, Wis			[4, t,S,E, \$1,350]	6, 50, r,t,S,E, \$2,500 6, 60, r,t,S,E, \$2,750	************	
pperson	Apperson Bros. Auto Co., Kokomo, Ind			6, t,S,E, \$1,485	6, r,t,S,E, \$2,200		*************
ArBenz	ArBenz Car Co., Chillicothe, Ohio			6, t,S,E, \$1,485 4, 48, r,S,E, \$1,825 4, 48, t,S,E, \$1,885			
Auburn	Auburn Automobile Ce., Auburn, Ind.		4, 36, r,t,S,E, \$1,075	6, 47, t,S,E, \$2,000	+	6 40 rt S E \$3 600	6 49 ISE 84 700
lenham	Austin Automobile Co., Grand Rapids, Mich. Benham Manufacturing Co., Detroit, Mich. Briscoe Motor Co., Inc., Jackson, Mich.				6, 48, r,t,S,E, \$2,485.	0, 40, 7,6,0,12, \$5,000	0, 40, 1,0,12, 91,100
Briscoe			4, 30, r,t,S,E, \$785	4. 30, c.S.E. \$1,250 (4. 37 t.S.E. \$1,250			
Buick	Buick Motor Co., Flint, Mich		. 4, 28, r,t,S,E, \$900.	4, 37, t,S,E, \$1,250. 6, 55, t,S,E, \$1,650.	0 91400 L/ C D 00 FO	V 21 40 60 1 C P 02 450	
adillac	Cadillac Motor Car Co., Detroit, Mich Cartercar Co., Pontiac, Mich			8,31to60r,t,S,E,\$1.975 4, 30, r,t,S,E,\$1,250	5,31,000,10.3.6.\$2,50	5, 31 10 00, 1,3,2,43,43	
lase	J. I. Case T. M. Co., Inc., Racine, Wis			4, 40, t,S,E, \$1,800 4, 25, r,t,S,E, \$1,350	************		
Chadwick	Chadwick Engine Works, Pottstown, Pa			(4, 20, 1)			6, 60, r,t,S,E, \$5,500 6, 60, l,S,E, \$6,500
halmers	Chalmers Motor Co., Detroit, Mich			6, 48, r,t,S,E, \$1,650. 6, 35, r,t,S,E, \$1,595.	6, 60, t,S,E, \$2,400	6, 48, c,s,S,E, \$3,200	[0, 00, 1,3,2, \$0,300
handler	Chandler Motor Car Co., Cleveland, O		[4, 24, r, \$750]		6, 35, l,s,S,E, \$2,750.		*************
hevrolet	Chevrolet Motor Co., Flint, Mich		4, 24, t, \$875)	6, 30, t,S,E, \$1,425	**************		************
Sole	Cole Motor Car Co., Indianapolis, Ind			4, 29, r, t, c, S, E, \$1,485 6, 29, r, t, c, S, E, \$1,865	6, 44, r,t,c,l,S,E, \$2,465		********
acy	Crane Motor Car Co., Bayonne, N. J.	4, 18, r, \$425					6. 46, chassis, \$7,500
Pane Filshart	Crow Motor Car Co., Elkhart, Ind		/4. 16, t.S.E. \$725	4, 29, t,S,E, \$1,495			
row-Elkhart	Crawford Automobile Co., Hagerstown, Md.		4. 26, t,S,E, \$1,175.	6 35 / S F \$1 850			
rescent	Crescent Motor Co., Cincinnati, Ohio			4, 29, t,S.E, \$1,275. 6, 38, t,S.E, \$1,985.		4 40 rtSE \$3 500	
unningham	Jas. Cunningham, Son & Co., Rochester, N.Y.			U. 38, 1,2,E, \$1,985	2120 2232 2000	2, 40, 13,63,D, \$6,000.	4, 40, l.ld.S.E. \$5,000
Davis	George W. Davis Motor Car Co., Richmond, Ind.		4. 24, r.S.E. \$795.	4, 38, r,t,S,E, \$1,235	6, 50, t,S,E, \$2,150		
De Tamble	De Tamble Motors Co., Anderson, Ind		4. 24. t.S.E. \$845.				
le Sata letroiter	De Soto Motor Car Co., Auburn, Ind Briggs-Detroiter Co., Detroit, Mich.	2, 10, r, \$325	4. 32, r.t.S.E.\$985				
Hispatch	Dispatch Motor Car Co., Minneapolis, Minn. Dodge Bros., Detroit, Mich.		4, 30, r, \$850 4, 35, t,S,E, \$785	4, 30, t,S,E, \$1,210			
Bodge	Dodge Motor Car Co., Detroit, Mich.	4, 30, r,S,E, \$595	2, 30, 1,0,2, 0100		111111111111111111111111111111111111111	1110 110 10 10 100	
horris	Dorris Motor Car Co., St. Louis, Mo. Empire Automobile Co., Indianapolis, Ind		4. 32. r.t.S.E. \$975.		4, 48, <i>t</i> , <i>S</i> , <i>E</i> , \$2,200	4, 48, <i>I</i> , <i>S</i> , <i>E</i> , \$3,400	
lnger	Enger Motor Car Co., Cincinnati, Ohio		************	6, 50, r,t,l,S,E, \$1,495.	6, 30, r.t.S.E. \$2,150.		
ranklin	H. H. Franklin Manf. Co., Syracuse, N. Y				6, 30, s,S,E, \$3,000.		
ord	Ford Motor Co., Detroit, Mich	4, 20, r,E, \$440 4, 20, t,E, \$490	4, 20, c,E, \$750 4, 20, s,E, \$975				
Nat	F. I. A. T., Poughkeepsie, N. Y.	(4, 20, 1,12, \$100	(4, 20, 3,2, 40,0				4. 55, r,t,S,E, \$4,650 6. 50, r,t,S,E, \$5,150
Trestone-Columbus	New Columbus Buggy Co., Columbus, Ohio			4, 35, r.t.c,S.E, \$1,850.	6, 60, r.t.l.S.E. \$2,600.		(0, 00, F,1,0,E, \$0,100
Mankage		4, -, r,t,S,E,\$595	4, -, s,S,E, \$845	**************	6 34 LS E \$2 350		
lide	Gary Automobile Mfg. Co., Gary, Ind., Bartholomew Co., Peorla, Ill Grant Motor Co., Findlay, Ohio		4, 30, t.S.E. \$1,195	***************	0, 01, 1,0,12, 02,000,		
irant ireat Western	Grant Motor Co., Findlay, Ohio Great Western Auto Co., Peru, Ind	4.21,r,t,l,S,E, \$505	6, 36, r.t.l.S.E. \$795.	4 40 r.t.S.E. \$1.710			
laynes	Haynes Automobile Co., Kokomo, Ind			6, 55, r,t,S,E, \$1,485. 6, 55, c,S,E, \$1,750. 6, 50, r,t,S,E, \$1,375.			
forff-Brooks	Herif-Brooks Corporation, Indianapolis, Ind.		4. 40, t.S.E. \$1,100.	6, 50, r,t,S,E, \$1,750			
lerreshoff	Herreshoff Light Car Co., Troy, N. Y., Holly Motor Co., Mt. Holly, N. J.	4, 10, r,S,E, \$500	4 * * * * * * * * * * * * * * * * * *		6, 45, t.S.E, \$2,750		
fudson	Hudson Motor Car Co., Detroit, Mich., Hupp Motor Car Co., Detroit, Mich.,		11 100 117 0190 01 1000	6, 40, r,p,S,E, \$1,550	6, 40, l,S,E, \$2,550		**************
Iupmobile	Imperial Automobile Co., Jackson, Mich.		4, 36, t,S,E, \$1,200 4, 36, t,S,E, \$1,085. 4, 30, t,S,E, \$1,000.	4, 36, c.s.S.E, \$1,325	6, 50, t.S.E. \$2,200.		
nter-State	Imperial Automobile Co., Jackson, Mich Inter-State Motor Co., Muncle, Ind		4, 30, t,S,E, \$1,000	A 45 - (S F @1 275			
ackson	Jackson Automobile Co., Jackson, Mich			4, 45, r.t.S.E. \$1,375. 6, 45, t.S.E. \$1,650. 4,38,r.t.s,l.S.E. \$1,450			
effery	Thomas B. Jeffery Co., Kenosha, Wis			4.38,r,t,s,l,S,E, \$1,450 6,42,r,t,s,l,S,E,\$1,650			**************
log	King Motor Car Co., Detroit, Mich.	************	4, 26, r,t,S,E, \$1,165		6. 48. r.t.S.E. \$2.350	6, 60, r,t,S,E, \$3,150	6, 60, <i>l</i> ,S,E, \$4,900
dine-Kar	Kissel Motor Car Co , Hartford, Wis Kline Motor Car Corporation, Richmond, Va.			4, 36, r,t,S,E, \$1,450 6, 42, r,t,S,E, \$1,850	6, 42, <i>l</i> , <i>S</i> , <i>E</i> , \$2,330	0, 00, 1,1,3,5, \$3,130	
čnox	Knox Motors Co., Springfield, Mass					4, 45, r,t,l,S,E, \$3,850.	6, 46, r,t,l,S,E, \$4,500 6, 66, r,t,l,S,E, \$5,000
irlt	Krit Motor Car Co., Detroit, Mich	************	4, 30, r.t.S.E. \$850.	4, 30, c,S,E, \$1,295			
ambert	Buckeye Manufacturing Co., Anderson, Ind		4, 25, r, \$950 4, 30, t.S.E, \$1,200.	6, 45, t,S,E, \$1,375 4, 40, t,S,E, \$1,450 6, 38, t,S,E, \$1,600			
ewis Six	LeP-C Motor Co., Racine, Wis Lexington Howard Co., Connersville, Ind	*********		6, 38, t,S,E, \$1,600 4, 40, r,t,S,E, \$1,375	6, 60, t,S,E, \$2,575		
exington		********		2, 20, 1,1,0,22, 02,010	of not divined aware or		6, 38, r.t.S.E. \$4,400
exemobile	Locomobile Co. of America, Bridgeport, Ct						6, 38, <i>l</i> , <i>S</i> , <i>E</i> , \$5,400 6, 48, <i>r</i> , <i>t</i> , <i>l</i> , <i>S</i> , <i>E</i> , \$5,100
ozier	Lozier Motor Car Co., Detroit, Mich Luverne Automobile Co., Luverne, Minn				4, 29, r,t,S,E, \$2,100	6, 36, t , S , E , \$3,250	6, 36, l,S,E, \$4,625
gons-Knight	Lyons-Atlas Co. Indianapolis Ind				6, 60, r,t,S,E, \$2,500 4, 32, r,t,S,E, \$2,900	4, 32, s,S,E, \$3,900	4, 32, <i>l,S,E</i> , \$4,300
	Marion Motor Co., Indianapolis, Ind			4, 36, r,t,S,E, \$1,650	6, 50, r,t,S,E, \$2,150	C 41 -4 C E 40 000	6, 48, r.t.S.E. \$5,000
	Nordyke & Marmon Co., Indianapolis, Ind.	************			*********	6, 41, r,t,S,E, \$3,250	6, 48, l,S,E, \$6,500
I BNOD	Mason Motor Co., Waterloo, Iowa	4, 25, t, \$695	4, 55, <i>l</i> ,S,E, \$1.150				**************
laswell,	Maxwell Motor Car Co., Detroit, Mich.	\4, 25, c, \$840			***********	6 38 c S E \$3 300	
icFarlan	McFarlan Motor Co., Connersville, 1nd				6, 38, r,t,S,E, \$2,590	6, 38, c,S,E, \$3,300. 6, 38, l,S,E, \$4,000	
felntyre	W. H. McIntyre Co., Auburn, Ind Metz Co., Waltham, Mass.	4, 23, t,S,E, \$695 4, 22, r, \$495		6, 28, t , S , E , \$1,275			
litchell	Mitchell-Lewis Motor Co., Racine, Wis.			4, 35, r.t.l.S.E. \$1,250	6, 60, t,S,E, \$2,350.		**************
Ioline-Knight	Moline Automobile Co. East Moline, Ill.			6, 50, r,t,S,E, \$1,895,	4, 50, r,t,S,E, \$2,500	4, 50, l,S,E, \$3,800	
lonarch	Monarch Motor Car Co., Detroit, Mich Moon Motor Car Co., St. Louis, Mo.			6, 45, t,S,E, \$1,250 4, 38, t,S,E, \$1,350	6 50 4 5 17 49 250		
loyer	H. A. Moyer, Syracuse, N. Y.	*************			4. 32. r.t.S.E. \$2,400	6, 48, t,S,E, \$3,250	
ational	National Motor Vehicle Co., Indianapolis., Ind				4, 32, r,t,S,E, \$2,400 6, 55, r,t,S,E, \$2,375 6, 55, c,S,E, \$2,850 6, 60, r,t,S,E, \$2,850		
orwalk	Norwalk Motor Car Co., Martinsburg, W.Va. Oakland Motor Car Co., Pontiac, Mich. Olds Motor Works, Lansing, Mich.		1 70 6 S F 81 100	6, 30, r.t,S.E, \$1,875 6, 54, t,S.E, \$1,685	6, 60, r,t,S,E, \$2,850.		*******
akland	Olds Motor Works, Lansing, Mich		4, 39, r,S,E, \$1,100.	4, 30, r,t,S,E, \$1,285	6, 50, t,S,E, \$2,975	*************	
	Willys-Overland Co., Toledo, Ohio		4, 30, t,S,E, \$850 4,35,r,t,S,E, \$1,050	6, 50, t,S,E, \$1,475		********	
			I - Inch intraver & times			(6, 38, r,p,S,E, \$3,750	
verland	Packard Motor Car Co., Detroit, Mich.						
verland	Packard Motor Car Co., Detroit, Mich		1, 36, r,t,S,E, \$1,195	6, 46, r,t,S,E, \$1,395		6, 38, <i>t</i> , <i>S</i> , <i>E</i> , \$3,850	6, 48, <i>l</i> , <i>S</i> , <i>E</i> , \$6,100
verland	Packard Motor Car Co., Detroit, Mich. Paige-Detroit Motor Car Co., Detroit, Mich. Partin Manufacturing Co., Chicago, Ill	/*************************************	1, 36, r,t,S,E, \$1,195 4, 38, t,S,E, \$1,075	6, 46, r,t,S,E, \$1,395		(0, 38, 1,3,£, \$3,830	
verland	Paige-Detroit Motor Car Co., Detroit, Mich.		1, 36, r,t,S,E, \$1,195 4, 38, t,S,E, \$1,075 4, 20, r,S, 4, 32, t,S,E, \$1,095		6, 50, r,t,S,E, \$2,222	(0, 38, 1,3,£, \$3,830	



The True Test of Tires

JETERAN drivers, beginners and prospective motorists are drawn to the Automobile Show to inspect the many new things in motordom.

The tire problem confronts them all.

Firestone success shows that veterans have settled the question by using Firestone Tires exclusively.

> Beginners and "prospectives" would save time, miles of service and money by taking advantage of the experience of older drivers.

Firestone Tires are standard; they have earned for themselves a name that amounts to prestige.

This prestige has actual merit to back it.

"Most Miles per Dollar"

This is the true test of tires—the test of quality, design, workmanship—the test that means economy and satisfaction.

All dealers have Firestones - or can get them promptly.

FIRESTONE TIRE AND RUBBER CO.

'America's Largest Exclusive Tire and Rim Makers

Akron, Ohio-Branches and Dealers Everywhere

itestonic non-skid tires

Which Pleasure Car Fits the Buyer's Purse?-Concluded

Name of Car	Name and Address of Manufacturer	Under \$700	\$700 to \$1,200	\$1,201 to \$2,000	\$2,001 to \$3,000	\$3,001 to \$4,000	Over \$4,000
Peerless.	Peerless Motor Car Co., Cleveland, Ohio,			4, 22, r,t,l,S,E, \$2,000.			6, 48, r.t.l.c.S.E. \$5.000
Pierce-Arrow	Pierce-Arrow Motor Car Co., Buffalo, N.Y.						6, 38, <i>t</i> , <i>S</i> , <i>E</i> , \$4,300 6, 48, <i>t</i> , <i>S</i> , <i>E</i> , \$5,000
Pilot	Pilot Motor Car Co., Richmond, Ind			6, 55, t,S,E, \$1,885	6, 75, r,t,S,E, \$2,885		6, 66, t,S,E, \$6,000
Pratt	Elkhart Carriage and Harness Co., Elkhart, Ind.			4, 40, 1,S,E, \$2,000	6, 50, r,t,S,E, \$2,150		
Premier	Premier Motor Manf. Co., Indianapolis, Ind. Pullman Motor Car Co., York, Pa		4, 30, r,t,S,E, \$740.		6, 32, r,t,S,E, \$2,385 6, 48, r,t,S,E, \$2,500		
Rayfield	Rayfield Motor Co., Chrisman, III	4, 18, r.S.E. \$475.					
R-C-H	R-C-H Corporation, Detroit, Mich. Regal Motor Car Co., Detroit, Mich.		4, 25, t,S,E, \$900 4, 39, r,t,S,E, \$1,085				
Republic	Reo Motor Car Co., Lansing, Mich. Republic Motor Car Co., Hamilton, Ohio.				6, 60, t,S,E, \$2,950		
Richard Richmond	Richard Auto Manf. Co., Cleveland, Ohio, Wayne Works, Richmond, Ind		4 40 r.t.S.E. \$1.125	6. 50. r.t.S.E. \$1.375			
S. G. V.	S. G. V. Co., Reading, Pa Saxon Motor Co., Detroit, Mich.	4. 15. r.S.E \$465			4, 35, r,t,S,E, \$2,800		4, 40, l,S,E, \$4,250
Simplex	Simplex Automobi le Co., New Brunswick, N.J. Singer Motor Co., Inc., Long Island City, N.Y.				6 60 rt S F \$2 350		4, 46, l,S,E, \$4,500
Speedwell	Speedwell Motor Car Co., Dayton, Ohlo. Spenny Motor Car Co., Chicago, Ill.				6, 41, r.t.S.E. \$2,850		
Sphinx	Sphinx Motor Car Co., York, Pa Carl Speerer Sons Co., Baltimore, Md.	4, 28, t.S.E \$ 695					
speererstearns	F. B. Stearns Co., Cleveland, Ohio			4, 22, r,t,S,E, \$1,750.	4, 40, 7,1,0,22, \$0,000.	4, 29, r,t,S,E, \$3,750	6, 46, r,t,S,E, \$4,850
Stevens-Duryes	Stevens-Duryea Co., Chicopee Falls, Mass						6, 46, <i>t</i> , <i>l</i> , <i>S</i> , <i>E</i> , \$4,550 6, 46, <i>l</i> , <i>S</i> , <i>E</i> , \$5,800
tudebaker	Studebaker Corp., Detroit, Mich		4, 20, r,t,S,E, \$985	6, 29, t,S,E, \$1,385			6, 48, l,b,p,S,E, \$6,200
Stutz	Stutz Motor Car Co., Indianapolis, Ind			6, 50, r,t,S,E, \$1,475.		6, 60, t,l,S,E, \$3,675	
Couraine	E. R. Thomas Motor Car Co., Buffalo, N.Y. Touraine Co., Philadelphia, Pa Travefer Motor Car Co., Detroit, Mich.					6, 43, r,t,l,S,E, \$3,250. 6, 60, t,S,E, \$3,250	6, 60, I,S,E, \$4,550
Telle.	Velie Motor Vehicle Co., Moline, Ill			6, 40, r,t,S,E, \$1,595	6, 50 r,t.S.E. \$2,015		
Vulcan Vestcott	Vulcan Manf. Co., Painesville, Ohio. Westcott Motor Car Co., Richmond, Ind White Co., Cleveland, Ohio.		4, 33, t,S,E, \$912 4, 35, r,t,S,E, \$1,185.	6, 50, r,t,S,E, \$1,585			
Valte Villys-Knight	White Co., Cleveland, Ohio				4, 30, r,t,s,S,E, \$2,700. 4.138, r,t,S,E, \$2,750	4, 45, t,l,ld,S,E, \$3,800	6, 60, t,S,E, \$5,500
Vinton	Winton Motor Car Co., Cleveland, Ohio Zimmerman Manufacturing Co., Auburn, Ind					6. 48. r.t.S.E. \$3.250	
	minimum management of the second at and the			of one desiral datago.	L/Bi		

Which Electric Pleasure Car Fits the Buyer's Purse?

A Self-explanatory Table of the 1915 Models of American Pleasure Cars

Name of Car	Name and Address of Manufacturer	Under \$2,500	\$2,500 to \$3,000	Over \$3,000.
Argo Baker Borland Bailey	American Electric Car Company, Saginaw, Mich Baker Motor Vehicle Co., Cleveland, Ohio American Electric Car Company, Saginaw, Mich S. R. Balley & Co., Inc., Boston, Mass	2p Roadster, \$2 300	3p Coupe, \$2,800	4p Brougham, \$3,250 7p Limousine, \$5,500
Broc	S. R. Balley & Co., Inc., Boston, Mass. Beardsley Electric Company, Los Angeles, Cal. American Electric Car Company, Saginaw, Mich		5p Brougham, \$3,000	5p Brougham, \$3,100
Buffalo Century Chicago	Buffalo Electric Vehicle Company, Buffalo, N. Y. Chicago Electric Car Co., Detroit, Mich. Chicago Electric Motor Car Company, Chicago, Ill.	/	4p Brougham, \$2,650 4p Lim., \$2,600, 5p Lim., \$2,800	5p Coupe, \$3,250 5p Brougham, \$3,250
Columbus	New Columbus Buggy Company, Columbus, Ohio	4p Colonial Coupe, \$2,350	4p Brougham, \$2,800	
Flanders Fritchie Frinneli	Flanders Electric, Inc., Detroit, Mich. Fritchie Auto and Battery Company, Denver, Colo Grinnell Electric Car Co., Detroit, Mich.	4p Coupe, \$1,750 2p Torpedo Roadster, \$2,400	4p Torpedo Roadster, \$2,500. 4p Brougham, \$3,000.	5p Brougham, \$3,600 5p Brougham, \$3,400
Ohio	Ohio Electric Car Company, Toledo, Ohio		3p Roadster, \$2,650	5p Coupe, \$3,200
Ward	Rauch & Lang Carriage Co., Cleveland, O	4D Coupe. \$2,100		5p, Coach. \$3,200
	Waverley Company, Indianapolis, Ind. Woods Motor Vehicle Company, Chicago, Ill.	4p Brougnam, \$2,300	5D Limousine, \$3,000	

Business Man's Reference Table of Commercial Vehicles

The Latest Models of American Gasoline Motor Trucks and Delivery Cars, Arranged According to Tonnage Carrying Capacity

Compiled by C. Edward Palmer

FOR a business which warrants the purchase of commercial vehicles to haul its goods great care is usually exercised, both by the buyer and the seller, to select a vehicle of the proper horse-power and body capacity for the particular class of goods to be handled. For this reason the business man is usually interested more in the size and capacity of a truck than in its price.

In the following table the vehicles are listed alphabetically according to name, and are grouped according to tonnage capacity. In the tonnage columns, the first figure indicates the tons capacity, and the second the horse-power of the truck at the price given. As most manufacturers build bodies to order, to suit the business of the purchaser the prices given are mostly for chassis only

chaser, the prices given are mostly for chassis only.

Motor truck manufacturers have made a careful study of the transportation requirements of many businesses and are glad to co-operate with purchasers in the efficient installation of commercial vehicle service.

Name of Vehicle Name and	Name and Address of Manufacturer	Tons Capacity, Horse-power and Price												
		Uno	ier 1 ton	1	1 - 13	6	2	- 21/2	3	- 31/2		4	5	6 and over
dams	Adams Bros. Co., Findlay, Ohio Actna Motor Truck Co., Detroit, Mich.			114	\$2.1	50	216	\$2.400	1					
nerican Daimler mleder	General Vehicle Co., Inc., Long Island City, N. Y. O. Armleder Co., Cincinnati, Ohio. Atterbury Motor Car Co., Buffaio, N. Y.			1, 3	0, \$2,	200°.	2, 40,	\$2,150						6, 35
anable	Available Truck Co., Chicago, III			11.30	0		2, 40,							
iglaize.	Avery Co., Peoria, Ill. Auglaize Motor Car Co., New Bremen, Ohio	36. 2	28, \$950.	1. 33	2. \$1.:	200.1								
rker Motor Wagon	Autocar Co., Ardmore, Pa. C. L. Barker, Norwalk, Conn. Bessenner Motor Truck Co., Grove City, Pa.			1.3	2,000	008	2, \$2,	400						
ockwayick	Blair Motor Truck Co., Newark, Ohio, Brockway Motor Truck Co., Cortland, N. Y Bulck Motor Co., Flint, Mich	34. 3	0, \$1,250 8, \$1,150	114.	25.\$1	,650	2, 35,	\$1,950						
ry Trucks	Mercury Manufacturing Co., Chicago, Ill.	36.14	4.3750	1 36.	30.83	400								
s and Independent	Independent Motors Co., Port Huron, Mich. Famous Manufacturing Co., East Chicago, Ind. Chase Motor Truck Co., Syracuse, N. Y.	34. 2	3, \$1,285	1, 24	27,\$1 4, \$75	.850	2, 35,	\$1,250	3, 4	5. \$1,750				
rk	Chase Motor Truck Co., Syracuse, N. Y. Clark Delivery Car Co., Chicago, Ill. F. Coleman Carriage and Harness Co., Illon, N. Y.	32, 1	5, \$750.	1 1/2.	30, \$2	,800		00.550	3, 40), \$3,300				*********
	Commerce Motor Car Co., Detroit, Mich. Corbitt Automobile Co., Henderson, N. C.													16 55 8 5
ible Gear	Couple Gear Freight Wheel Co., Grand Rapids, Mich				****						4, 45	\$5,000.		12,70,\$6,



Roll of Honor
The Names shown below represent some of the users of Detroit Springs

Pleasure Cars

Cole Lyons-Knight
Dodge Bros.

Marmon Hupmobile National Kissel Kar

Oakland Pathfinder
Detroit Electric

Trucks

Denby Republic
Federal Signal
G. M. C. Standard
Krebs J. C. Wilson

Individually Designed

DETROIT Springs are built to such a high standard that we are able to guarantee them for two years. In the first place, they are designed and built for the particular model of car upon which they are to be used.

They are built for more than safety, that is— Emergency Shocks.

They are built for lasting Comfort—for Car Protection—minimum wear on mechanism and tires.

In addition to the Two-Year Guarantee and all the quality that implies, is the Self-Lubricating feature.

Near the end of each leaf is a small saucer-like depression filled with a long-lived lubricant, which spreads between the leaves as they move over each other.

By this simple device, Detroit Springs always operate smoothly and silently.

Write for free book, "From the Ore to the Motor Car," telling how springs are made.

Detroit Steel Products Co.

2230 East Grand Boulevard, Detroit, Michigan



A Business Man's Reference Table of Commercial Vehicles.-Concluded

Name of Vehicle	Name and Address of Manufacturer	Tons Capacity, Horse-power and Price									
		Under 1 ton	1 - 1 12	2 - 214	3 - 339	4	5	6 and over			
Croce	Croce Automobile Co., Asbury Park, N. J. Crown Commercial Car Co., North Milwaukee, Wis	54. 22, \$1,800	1, 28, \$1,850 1, 28, \$2,000	2, 30, \$2,600	3, 36, \$3,600						
Duplex Four-wheel Drive Dorris	Dunlay Power Car Co Charlotte Mich	54, 48, \$1,956	25, 25, 62,000	2, 32, \$2,800 2, 48, \$2,500	3, 40, \$3,200						
Doyle	Dorris Motor Car Co., St. Louis, Mo. J. C. Doyle, Seattle, Wash Diamond T Motor Car Co., Chicago, Ill Dispatch Motor Car Co., Minneapolis, Mien Donly Motor Truck Co., Deposit Mich.	37 25 \$2 000	1 ½,30.\$1.750 1 ½,30,2,250	2 30 \$2 500	3, 50, \$2,750 3, 40, \$3,600			10, 90, \$4,750			
Dispatch Denby	Dispatch Motor Car Co., Minneapolis, Minn Denby Motor Truck Co., Detroit, Mich	32, 30, \$900. 34, 20.	1 20		************						
Delahunty Dart	Delahunte Desing Machine Co. Pitteton De	14, 20, \$875.	11 56 3D X1 NO	0 05 61 600	**********						
Durable Dayton	Dart Motor Truck Co., Waterloo, Ia Durable Dayton Truck Co., Dayton, Ohio Farron Motor Car Co., Chicago, Ill.	72, 20, 0010.	1. 24, \$1,400.	2, 36, \$1,800.	3, 45, \$2,250	4, 45, \$2,700	5, 60, \$3,100	6, 60, \$3,500			
Fargo Four-Wheel Drive Federal	Fargo Motor Car Co., Chicago, Ill Four-Wheel Drive Auto Co., Clintonville, Wis Federal Motor Truck Co., Detroit, Mich		1, 23, \$1,250 1 1,30,\$1,800	2, 29, \$3,600				6, 44, \$4,800			
Flint. Fremont-Mais	Durant-Dort Carriago Co., Flint, Mich Lauth-Juergens Motor Car Ce., Fremont, Ohio				da						
G. M. C	General Motors Truck Co., Pontiac, Mich.	34, 20, \$1,090	1 ½,30,\$1,700 1 ½,20,\$1,500 1,30,\$2,000 1 ½,35,\$2,400	2, 26, \$1,900	3 12, 40, \$2,500		5, 40, \$3,000				
Gabriel	Gabriel Auto Co., Cleveland, Ohio	34,22,\$1,000 34,28,\$1,600	1,30,\$2,000 114,35,\$2,400								
Garford	Garford Co., Elyria, Ohio. 8. G. Gay Co., Ottawa, Ill.		1 14,30,\$1,700 1 12,\$1,800		3, 29, \$3,500.	4, 29, \$3,850	5, 29, \$4,500.	6, 29, \$4,850			
B. A. Gramm	8. G. Gay Co., Ottawa, Ili Gramm-Bernstein Co., Lima, Ohio Hahn Motor Truck and Wagon Co., Hamburg, Pa		1. 200	2, \$2,600 2, 40,	3½, \$3,500 3, 45,			6, \$4,300			
Handy Wagon	Auburn Motor Chasis Co., Auburn, Ind	{14, 11, \$295. \$, 18, \$575.									
Harvey Hendrickson	Harvey Motor Truck Works, Harvey, III Hendrickson Motor Truck Co., Chicago, III		1 14,30,\$1,800	2 30 \$1 850	3, 40, \$3,000.	4 45 83 400					
Horner Hupmobile	Hendrickson Motor Truck Co., Chicago, III Detroit-Wyandotte Motor Co., Wyandotte, Mich Hupp Motor Car Co., Detroit, Mich Hurlburt Motor Truck Co., New York City	ž, 32, \$1,050	1 ½,30,\$1,800 1 ½,30,\$1,550 1, 33, \$2,000	2, 33, \$2,650	3, 36, \$3,200		5, 46, \$4,200.	**********			
Hurlburtdeal	Hurlburt Motor Truck Co., New York City	E. 32, 01,000 .	1, 22, \$1,500	2, 28, \$3,000	3 12, 32, \$3,500						
nterboro nternational	Ideal Auto Co., Fort Wayne, Ind Interoboro Motor Truck Co., Philadelhpia, Pa International Harvester Corp., Chicago, Ill	12, 20,	1 1/2.35, \$2,000 1, 23, \$1,850.	. 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			**********				
cale many	Kalamazon Motor Vohicle Co. Ka. mason Mich	34, 38, \$1,300	1, 35, \$1,500	2, 38, \$2,750							
Kelley-Springfield	Kelley-Springfield Motor Truck Co., Springfield, Ohio A. R. King Manufacturing Co., Kingston, N. Y Kissel Motor Car Co., Hartford, Wis		1 ½ .30, \$1,590 1, 30, \$2,000	2, 30, \$2,750	332,40,\$3,400	4, 40, \$3,685	5, 40, \$4,250	6, 40, \$4,550			
Cissel Kar	Kissel Motor Car Co., Hartford, Wis	34, 36, \$1,500	1, 36, \$1,850					6, 50, \$4,350			
Cnickerbocker Cnox Tractor	Knox Motor Co., Springfield, Mass.	***				4, 40, \$4,000	5, 40, \$4,500 5, 40, \$3,250 ^a				
Coehler	Knickerbocker Motor Truck Manufacturing Co., New York City, Knox Motor Co., Springfield, Mass, I. J. Koehler Sporting Goods Co., Newark, N. J. Kopp Motor Truck Co., Buffalo, N. Y.		1, 24, \$750	2. 30.	314. 38.			6 49			
Cosmath	Kosmath Co., Detroit, Mich	\$\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\									
aFrance-Hydraulic	Krebs Commercial Car Co., Clyde, Ohio. American LaFrance Fire Engine Co., Inc., Elmira, N. Y.	4, 23, \$1,450	1, 23, \$1,900.	2, 28, \$2,350				614,48,\$5.500			
ambertange	American LaFrance Fire Engine Co., Inc., Elmira, N. Y. Buckeye Manufacturing Co., Anderson, Ind. Lange Motor Truck Co., Pittsburg, Pa. Lewis Motor Truck Co., Inc., Oakland, Cal	2, 25, \$950	1 14,35,\$1,900 1 14,23,\$2,250	2, 40, \$2,300		.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
ewis Ippard-Stewart	Lewis Motor Truck Co., Inc., Oakland, Cal	20 61 650	1, 30, \$2,000	212,35,\$2,900	3, 35, \$3,250.		5, 50, \$4,400.	6, 50, \$4,500			
ittle Giant	Lippard-Stewart Motor Car Co., Buffalo, N. Y Shicago Pracumatic Tool Co., Chicago, Ill., occombile Company of America, Bridgeport, Conn.	*** ** ***	1, 20, \$1,000.								
ongest	Longest Brothers Co., Louisville, Ky	*** **********				4, 30, \$3,650 4, 40, \$4,000	5, 40, \$4,500				
lartin	Mais Notor Truck Co., Indianapoins, Ind Martin Carriage Works, Inc., York, Pa Mansur Motor Truck Co., Haverbill, Mass V. H. McIntyre Co., Auburn, Ind	***	1 1/2,40,\$2,750 2 1 1/2,30,\$2,150 2	232,35,\$2,850	3 ½,50, \$ 3,500						
lansur Icintyre	V. H. McIntyre Co., Auburn, Ind.	*** *********	1 12,30,\$2,150 2 1 12,30,\$2,300 1 1 12,28,\$2,300 2	2, 28, \$2 800.	3, 35, \$ 3,000 3, 28, \$ 3,200						
fenominee 1	D. F. Poyer Co., Menominee, Mich.										
	dowling Green Motor Truck Co., Bowling Green, Ohio	+1 - *********	1 34, 35, 1,800 1, 27, \$1,750 1 34,32,1,950	2, 36, \$2,300				******			
A section of	Pacific Metal Products Co., Torrence, Cal Moreland Motor Truck Co., Los Angeles, Cal	34, 23, \$1,800	14,27,\$2,050 2	2, 32, \$2,500 2 14,34,\$2,650	3 14.34.83.350		5, 44, \$4,500. 5, 34, \$4,000	614.44.84.500			
elson & LeMoon	Vational Motor Truck Co., Bay City, Mich.		1, 25, \$1,925.	35. \$2.250	3. 40. \$2.750						
ew York	toreand Motor Truck Co., Las Angeress, Ca. actional Motor Truck Co., Bay City, Mich ledson & LeMoon, Chicason, Chicason, Chicason geothesie & Riepe Co., New York City centucky Wagon Mg. Co., Louisville, Ky lid Reliable Motor Truck Co., Chicago, fil. Hilly Soverland Co., Toledo, Ohio ackard Motor Car Co., Detroit, Mich.	BAY COLUMN CONTRACTOR	34,32,\$1.800 34,\$2,000	**********							
id Reliable	old Reliable Motor Truck Co., Chicago, Ill	*** 4*******	12, 25, \$2,250 2	2, 35, \$2,750 3	3, 35, \$3,400			7, 50, \$6,000			
ackard	ackard Motor Car Ce., Detroit, Mich., almer-Meyer Motor Car Co., St. Louis, Mo.		, 30, \$1,600. 2	2, 26, \$2,000 . 3	3, 32, \$3,400.		5, 40, \$4,150.				
Imer-Moore P	almer-Moore Co., Syracuse, N. Y. eerless Motor Car Co., Cleveland, Ohio ferce Arrow Motor Car Co., Buffalo, N. Y.	***	, 32, \$1,350.			4, 33, \$4,000		0 22 05 000			
erce Arrow P	ferce Arrow Motor Car Co., Buffalo, N. Y. eo Motor Truck Co., Lansing, Mich.		2				5, 38, \$4,500.				
	epublic Motor Truck Co., Alma, Mich	34, 25, \$995	1,35,\$1,350.		********						
obinson	obinson Motor Truck Co., Minneapolis, Minn		9	36, \$2,500.	134,45,\$3,400		5, 50, \$3,800				
owe	oland Gas-Electric Vehicle Co., New York City owe Motor Manufacturing Co., Downingtown, Pa oyal Motor Truck Company of New York Brooklyn, N. Y.	i i i i i i i i i i i i i i i i i i i	14,30,\$2,000 14,32,\$2,450 2	40 \$2.800 3	48 \$3.400		5, 48, \$4,500				
ndow Sa	andow Truck Co., Chicago, III. anford Motor Truck Co., Syracuse, N. Y.	i i i i i i i i i i i i i i i i i i i	, 30, \$1,800. 2	, 35, \$2,350. 3	36,36,\$3,400 45,\$3,000	4, 45, \$3,600	5, 40, \$4,500				
hacht. G	A Schacht Motor Truck Co. Cincinnati Ohio		14,20,\$2,000	, 26, \$2,000 , 40, \$2,800 . 3	40, \$3,200						
rvice. Se	slden Motor Vehicle Ce., Rochester, N. Y. rvice Motor Truck Ce., Wabash, Ind. tie Shop of Siebert, Toledo, Ohio.	1	, 22, \$2,000. 2	27, \$2,500. 3	30, \$2,975		6, 40, \$4,000				
	gnal Motor Truck Co., Detroit, Mich.	4, 22, \$1,250	1, 23, \$1,400 .								
alth A	O. Smith Co., Milwaukee, Wis.				\$3,500 4	1, \$3,750		3. \$4.750			
eedwell SI	outh Bend Motor Car Works, South Bend, Ind beedwell Motor Car Co., Dayton, Ohio	1	3 ₂ ,30, \$ 1,750 2,	. 40, \$1,850. 3	, 80, \$2,850.	* *** *** *** ***	5, 95, \$3,250 5, 45, \$3,300 6, 40, \$4,000	10, 120, \$5,000			
sele St	andard Motor Truck Co., Detroit, Mich , M. Steele, Worcester, Mass	\$4, 30, \$1,600 1 14, 20, \$850.		30. \$2.500. 3	45, \$2,750 40, \$3,000 4	. 40, \$3,500	5, 45, \$3,300 . 6, 40, \$4,000				
erlingSt	M. Steele, Worcester, Mass egeman Motor Car Co., Milwaukee, Wis erling Motor Truck Co., Milwaukee, Wis	\$4, 30, \$1,600 1	54,30,\$2,100 2	12.35,\$2.800 3 23 \$2.800 3	34,45,\$3,350 . 29 \$3,400		5, 50, \$4,200 . 37, \$4,500	40 84 750			
ewart. St idebaker St	ewart Motor Corporation, Buffalo, N. Y udebaker Corporation of America, Detroit, Mich	34, 30, \$1,500 34, \$985									
			30, \$2,000 2	35 \$9 700			*********				
ansit Ti	ffln Wagon Co., Tiffu, Ohio. Truck Co., Louisville, Ky asie Motor Car Co., Minneapolis, Minn	16 16 8450	, 30, \$2,000. 2,	35, \$2,850. 3	16,45,\$3,500		45, \$4,500				
ile Ve	dile Motor Car Co., Millieapolis, Milli elie Motor Vehicle Co., Moline, Ill. lover Leaf Milling Co., Buffalo, N. Y	16, \$450	30, \$2,000 2 30, \$2,000 2 40, \$2,000 2 ½,30,\$2,250	12,45,\$2,850	40 40 400	45, \$3,350. 5	45, \$3,750	*********			
m To	over Lear Milling Co., Buralo, N. Y buraine Co., Philadelphia, Pa. avis Manufacturing Co., Milwaukee, Wis	14 20 \$620	72,00,00,000		, 20, 40, 200.		. 20, 40,500.				
lean De	riggs-Seabury Ordnance Corporation, Sharon, Pa.	14, \$395. 14, 10, \$300. 14, 10, \$300. 14, 30, \$2,250 1 14, 30, \$1,000 1 14, 30, \$1,600 1 14, 30, \$1,550 1 15, 30, \$1,550 1	2,	30, \$2,750. 3	30, \$3,250 4	30, \$4,000. 5	30, \$4,500. 7	30, \$6,000			
Malter (Truck & Tractor) W	ade Commercial Car Co., Holly, Mich alter Motor Truck Co., New York City	34, 10, \$300				5	, 40, \$4.500 1	2, 40, \$4,500			
ehita	hite Company, Cleveland, Ohio ichita Falls Motor Co., Wichita Falls, Tex E. Wilcox Motor Co., Minneapolis, Minn illet Engine and Truck Co., Inc. Buffalo. N. Y.	34, 30, \$2,250 1	32,30,\$3,150 30,\$1,650.2	35, \$2,100, 3	, 30, \$3,850 34,50,\$3,250.		, 40, \$4,700				
	E. Wilcox Motor Co., Minneapolis, Minn	34, 28, \$1,000 1.	30, \$2,000. 2,	35, \$2,500. 3	40, \$3,250						
leox Teux H. llet W. llys-Utidty Gr	tllet Engine and Truck Co., Inc. Buffalo. N. Y. ramm Motor Truck Co., Lima, Ohio. Isconsin Motor Truck Works, Baraboo, Wis.	34, 30, \$1,600 1.	. 30, \$1,850. 2.	35, \$2,600. 3.	40, \$2,800		*********				

Reference Table of Electric Commercial Vehicles

In the tonnage columns of the following table, the first figure indicates the tons capacity of the truck at the price given. As in the Gasoline Commercial Vehicle list, the prices are mostly for chassis only. Bodies are constructed to order, to suit the class of goods to be handled.

Name of Vehicle	Name and Address of Manufacturer	Tons Capacity and Price									
		Under 1 ton	1 - 11/2	2 - 216	3 - 3 1/2	4	5	6 and over			
Roffalo	American Electric Car Co., Saginaw, Mich Baker Motor Vehicle Co., Cleveland, O. Buffalo Ricettie Vehicle Co., Buffalo, N. Y	12. \$1.900	1, \$2,300	2, \$2,800	3 1/2, \$3,500		5, \$3,850				
Couple Gear	Couple Gear Freight Wheel Co., Grand Rapids, Mich. Commercial Truck Company of America, Philadelphia, Pa	12, \$1,640	wheel Driv	e)	3½, \$4,400 3½, \$3,530.		5, \$4,000 5, \$5,000 5, \$3,935	7, \$4,435			
Bldridge Slectruck 3. M. O.	J. C. Doyle, Seattle, Wash, Eldridge Manufacturing Co., Boston, Mass Los Angeles Creamery Auto and Machine Works, Los Angeles, Ca. General Motors Truck Co., Pontiac, Mich. General, Vehicle Co., Long Island City, N. Y.	34, \$2,900 32, \$1,200	1 ½, \$2,350	2, \$3,000 for milk delf 2, \$1,650	3, \$3,250 very.) 3, \$1,900	4, \$3,500 4, \$2,100	5, \$3,750 5, \$2,350	6, \$3,950 6, \$2,500			
loland	Kentucky Wagon Mfg. Co., Louisville, Ky Roland Gas-Electric Vehicle Corporation, New York City S. G. Schornfin Co., Buffalo, N. Y Kentucky Wagon Mfg. Co., Louisville, Ky. Walker Vehicle Co., Chicago, Ill.	34, \$1,600 34, \$1,560	1, \$2,000 1, \$2,000 1½, \$1,920	2 ½, \$2,530 2.	3, 3½, \$3,500	4, \$3,080					
Vard	Ward Motor Vehicle Co., Mt. Vernon, N. Y. Waverley Co., Indianapolis, Ind.	36, \$875 36, \$1,250	1, \$1,500	2, \$1,900	31/2, \$2,450		5, \$2,950				

A STATE OF

Why Uncle Sam Chose The Jeffery Quad

UNCLE SAM had a haulage problem. He wanted a motor truck

that was economical in peace and efficient in war. Furthermore, it should be able to travel anywhere his famous four-mule army escort wagons would go.

So the Jeffery engineers built the Jeffery Quad—which drives, brakes and steers on all four wheels and travels where any wheel or wheels can get traction. Uncle Sam bought the first Jeffery Quad made. He has been placing repeat orders for Jeffery Quads ever since.

WHEN Europe went to war, one of the first vital needs was for dependable motor trucks. Even before the great war broke out, when Europe's chancellories knew that any moment the eruption might come, a special rush order of Jeffery Quads

was on the way.

Europe's war experts are keen buyers. They know what best suits their purpose. The first Quads more than fulfilled requirements. That is why nearly every steamship that sails to Europe carries a consignment of Jeffery Quads.



UNCLE SAM is the most discriminating buyer in the world. His battleships and his navy are second to none. His army is small, for it is intended only as a nucleus. But it is mighty efficient—what it lacks in size it makes up in quality and equipment. That is why it had to have the Jeffery Quad.

Uncle Sam's haulage problems are the same as yours or mine—only a little more severe, perhaps. You cannot do better than take a tip from your Uncle Samuel, and trust your haulage problem to Jeffery engineers and the Jeffery Quad.

SNOW, mud, sand, steep hills and even roadless country have no terrors for the Jeffery Quad. In Death Valley, where the temperature reaches 135 in the shade—in the lumber camps of Northern Minnesota when it's 40 below zero—you can find the Jeffery Quad working under conditions where only pack mules or six-horse teams were formerly used.

If you possess this remarkable and unusual truck you can be making money when perforce the other fellow's trucks are idle. And according to the Law of Supply and Demand, your service is always at a premium when it is better than that of your competitors.

The Jeffery Quad will haul from 2 to 7 tons or more at less cost than any rear-drive truck made. It will keep on hauling when other vehicles are stalled. The Jeffery transportation engineers will be glad to show you how and why. Write for the new illustrated story-catalog on "The Jeffery Quad."

The Thomas B. Jeffery Company

Main Office and Works, Kenosha, Wis., U.S.A.

Cable Address "Jeffcar."

The Motor Truck of Peace

Will Supplant the "War-Priced" Truck Horse

The Electric Truck is the Motor Truck of Peace. In England, France and Germany, where about all the gasoline automobiles, motor trucks, taxicabs and motorcycles have been commandeered and every horse that can stand alone appropriated by the government, the Electric vehicle, and particularly the Electric Truck, has remained right in its own home town and been kept very, very busy.

The Electric Truck is the Motor Truck of Peace. It is not elected to compete in the army trials, but it is favored in the moving of smokeless powder, dynamite Twelve U. S. Navy Yards use G. V. Electrics because they are cleaner, safer and more efficient about the yards. No danger from explosion when among cotton, The Electric enjoys the preference in oils, waste, etc. freight sheds, in the cotton warehouses and about our big textile mills. It can be taken up in elevators and loaded and unloaded among excelsior, etc. Sanitary, too.

The success of Electric Trucks is not yet measured by the number in use, but in the efficiency of those at work. The more scientific motor trucking becomes the more Electric Trucks you will see in service.

Why Not "Team With Electricity"

The War will take away from 100,000 to 250,000 high grade horses and mules to Europe. This means that the clean limbed animal you have been paying \$250 for will cost you \$300 or even more by, say, next Spring. Again, 15,000 horses, worth \$3,250,000, died in the city of Spring. Again, 15,000 horses, New York alone in 1913. The and broken limbs in other cities. Thousands more died from glanders, heat ities. Then, too, it costs 90% more to feed a horse in the city than it did ten years ago.



Five-ton G. V. Electric equipped with winch, operated by current from the same battery which drives the truck.

Why not team with Electricity? It's coming, as sure as taxes. First we had man power, then animal power, water power, gas power—then Electric power. Look at the trend! Look at the 9000 Electric Trucks in a few cities.

G.V. ELECTRIC TRUCKS

Excel Everything In Their Field

There are several makes of good Electrics, but there is only one

Built first in 1901 and standardized in 1907, G.V. Electrics are now u Built first in 1901 and standardized in 1907, G. V. Electrics are now used in 42 of the 48 states and in 9 foreign countries. Over 4000 used by 126 trades; hundreds 7 to 13 years old. Six capacities, ranging from 1,000 to 10,000 pounds. Both worm drive and chain drive in the half-ton class. Our 14 years' experience, our large distribution and our ample resources are tangible assets to the buyer. We can't afford to sell you a G. V. Electric unless your work demands it—bad business for us. You can depend upon us to protect your interests in the matter of adaptability as we do our own.

Buy right and buy now! The Electric Truck is the greatest aid to economy in city teaming and light delivery that this century has produced. Investigate. Get. the facts. Get Catalogue No. 101, anyway.

General Vehicle Company, Inc.



NEW YORK

General Office and Factor Long Island City, N. Y.





Make Gasoline

(Concluded from page 5.)

Mr. Burton puts his valve beyond the condenser, so that pressure is applied not only to the liquids in the still but to the gases condensing in the coil.

In using the apparatus, there is intro duced into the still a quantity of the re-sidual portion of the paraffine series of petroleum distillation-let us say the distillate known as fuel oil, which has a boiling point of upward of 500 deg. Fahr. The valve is normally closed. Heat from the fire-chamber distills the volatile constituents and the resultant vapor courses through the pipe and soil, in which they are condensed. With the valve tightly closed against the escape of the products of condensation, the vapors of distillation accumulate and exert a high pressure, from 4 to 5 atmospheres, upon the liquid in the still, raising the boiling point from 500 or 600 deg. Fahr. to 700-800 deg. Fahr. This pressure of the vapors combined with their contained heat converts high boiling members of the paraffine series into low boiling members of the same series. The valve is opened from time to time to draw off the products of conden-sation into the receiver. The intervals of drawing off are sufficiently frequent to avoid filling the coil with liquid. meantime the relief valve is occasionally opened to relieve gas pres lower end of the coil, which is otherwise likely to obstruct operations.

The resultant gasoline is a product belonging to the paraffine series, the same as the petroleum residue from which it was distilled. Mr. Burton makes no attempt to account for the effect of the back sure from the extreme end of the condensed coil upon the contents of the holder in preventing transformation of the paraffine series into the objectionable ethylene series, but it is the fact that such

This method of distillation is continued until what is left is a thin, syrup-like residue, marking the limit of the Burton process when first patented. ever, been greatly improved since then. In the recently perfected process the residue is taken to a second still of ordinary construction, there to be subjected to heat at approximately atmospheric pressure until left in the still but The liquid product of this distillation is reintroduced into the first still, mixed with a new charge of the original fuel oil character, there to be again distilled under pressure.

The yields of finished gasoline that can be obtained by this process vary widely the character of the so-called fuel oil, which is used as a raw material. Oils derived from crude oil from one section of the world give much better results than oils derived from other sections. oils will give a yield of around 60 per cent of crude gasoline distillate, while others will not give so much.

The oil secured by redistilling the products from the original distillation are ore refractory than what might be called fresh" stock. It is therefore impossible to give definite figures as regards yields, but in a broad, general way it might be stated that the process in question will at least double the yield of finished gasoline prod-

ucts from a given crude oil.

It should be understood that the gaso line distillate thus produced, while usable in internal combustion engines, is not a deodorized product. To render it such requires redistillation and sulphuric acid

It is perhaps too early to say what this

Burton Process of "Cracking" to line, by the thousands of new automobiles and other calls for "motor spirit, ready met with a means for making several cobblestones out of one rock—several

Military Tactics and the Motor

and miles in the rear of the battle line, as far beyond the range of heavy fire as possible. Connection with the firing line is maintained by telepho motorcycle dispatch riders. In fact, latter are pressing the automobiles hard for honors in this field.

It is getting dark. A fog seems to settle over the battlefield, the smoke from burning farm houses, haystacks, and—well, and "other things"—hangs like a pall over verything. Suddenly a sputtering motorcycle flashes past at a speed of more than a mile a minute. In the continuous crack-ling of small guns and rifles the noise of the racing motorcycle is almost lost. Peering with eyes strained to the point of tears into the dim light ahead, his sharp electric horn screeching an alarm forward, the rider flashes by, at every instant of his ride flirting with death, because of the darkness ahead. Suddenly he shuts off the gas and slams down the brake with all his power. He just manages to stop as his front wheel touches the rear of a convoy truck going slowly to the Past the truck, ordering the driver rear. to stick farther to the right of the road, he goes, and soon he finds "his" truck detachment. An order to the driver in charge, and the whole convoy starts for the battle lines. The motorcyclist acts as guide, so as to insure quick delivery of the ammunition needed at such and such Each regiment has one or two such dispatch riders ready at all times. They sometimes get no real rest for days at a time, snatching a bit of sleep after having fetched one convoy to the point needed.

The ammunition column thunders past the watcher on the roadside. Powerful gasoline trucks, driven without any regard to efficiency or economy of operationsolely with the idea of getting there, and getting there as quick as the roads will Hardly has the column reached its destination when an urgent request is received by the commanding general for reinforcements to a certain danger point, The telephone carries the message to a motor column in the rear, and fifty motor buses, tractors with two and three trailers, all loaded to capacity, rush for-ward. Three additional regiments reach the point of danger within a fraction of the time it would have taken an old-fash-ioned "orderly" to gallop to the commanding general on the well-known "hill over-looking the battlefield." The "hill" in this case happens to be a captive balloon fully 3,000 feet above the trenches.

A lull in the bombardment. Wounded are picked up by the sanitary corps and carried to certain collection points in the rear of the trenches. Every little while motor ambulances call at these points and carry away those whom it has been possible to save under the artillery attack. The motor ambulances, in the case of the French armies, go back to cities in which facilities for the treatment of the wounded can be found, while in the case of the German armies well equipped hospital trains of twenty-five to thirty coaches wait at convenient gathering point behind the battle line, to which point the motor ambulances carry their loads.

Steam Tractors.

process was issued January 7th, 1913, and trucks as heavy tractors. For slow haulthe second, making use of the 35 per cent residue from the first "cracking," was issued August 4th, 1914. The fact that the Standard Oil Company is using the process in a plant built for the purpose is evidence of its commercial and practical burn small anthracite coal as well as utility as well as of its scientific interest.

Logically, if the process itself is as cheap
and economical as it appears to be, the
coming increase of consumption of gasocame near being wrecked because of the



The Operating Costs for Nearly a

CLAIMED that the New Alkaline Storage Battery would make the Elec-True Vehicle the cheapest means of Street Transportation, but I had only my private tests to satisfy me. Today thousands of Edison Batteries in thousands of Trucks and Delivery Wagons are making Operating Records that are easily investigated by all. After the four or five years of hard service that many of these vehicles have had, is it possible to deny that my claim is proved?

HERE IS ONE RECORD - A REPORT - ON 22 FIVE-YEAR-OLD EDISON BATTERIES



or Bulletins on the use of Edison Batteries for Lighting Houses, Ignition and Lighting of Casoline Cars, Yach ag, Railway Train Lighting and Signaling, Telephone, ph and Wireless and High-prited or Low-prited Passenger

Edison Storage Battery Company

Orange, New Jersey

Distributors in San Francisco Los Angeles Portland, Oregon Sentile

ADAMS EXPRESS COMPANY

242 WEST 47TH STREET

NEW YORK. December 7th 1914

Edison Storage Battery Company, Orange, N. J.

Thank you for consenting to extend from five to six years the conditions of your guarantee regarding renew-

The average operating cost per battery per month twenty-two trucks at Indianapolis, equipped with Edison Batteries in Govember 1909 and averaging about 660

month, is as follows:-BATTERY MAINTENANCE CURRENT

(Refilling, new solution, watering, cleaning, all repairs, inspection, etc.)

to this time the average mileage per truck was about 40,00

which reduces the operating cost to \$.02 per mile. batteries are still in



This Truck Tire Wins on the Cost Book

These 1915 Goodyear S-V Tires-pressed onto the wheel-now solve the truck tire problems that have baffled all makers. Goodyear experts worked 8 years for this triumph; and their research costs us \$100,000 yearly.

They built 74 separate tire structures of this type one. Then 2,100 test tires were made and run. On each we kept a careful record of cost and performance. Truck owners, also, tested these tires by the side of

These tests all prove conclusively that this is the final truck tire men have sought from the first.

Cut Cost 5 Ways

Note these definite economies that Goodyear S-V Truck Tires bring-

Reduce Tire Mile Cost-by giving 10% more available tread

Reduce Cost of Mounting Tires 75% to 85%-by ending preliminary work on wheels, ending the purchase of metal bands, flanges, bolts and wedges.

Save Cost of Carrying Excess Weight-by abolishing these metal fastenings on all four wheels

Reduce Depreciation-by correct cushioning; both the truck and load are protected.

Save Power-by means of Goodyear design and compound.

Keep Trucks Going

Every minute a truck is moving means money. Wrong tires cause costly "layups"—the time it takes to apply them, time for after-adjustments, time for frequent renewals and repairs.

Goodyear S-V Tires never do that.

They are applied in 5 or 10 minutes. No tinkering to make wheels conform-no fastenings to buy-no boring bolt holes.

For Goodyear experts discovered a process that welds in life-long unit the soft rubber tread, hard rubber backing and channel steel base.

See What Users Say

Write today for letters from truck owners, cost facts and full particulars. You owe this to your business. For you lose dollars every day you delay. Address Desk 132

The Goodyear Tire & Rubber Company, Akron, Ohio Makers of Goodyear Automobile Tire

We make Demountable Block Cushion and other Types of Truck Tires

se columns of smoke given off by the! steam wagons. The German artillery, ore than seven miles away, got the range the smoke column and big shells dropped amid the convoy, wrecking three of the Fodens and damaging others severely before the trouble with the fuel could be remedied. Besides the big fleet of 110 Fodens, there are about 80 other steam trucks, of four different makes, in use behind the battle lines. For slow, tractor work the steamers are pre ferred to the 50 and 100 horse-power gasoline trucks. Generally a complete fleet of steam wagons consists of about thirty vehicles, including a few trailers, a repair wagon, a 1,000-gallon water tank wagon with high speed pump installation, stores and equipment sufficient to make the enfleet self-sustaining for six months under war conditions. The personnel of such a fleet consists of one officer, sixteen non-commissioned officers, sixty drivers, mechanics, two boilermakers, smiths, two wheelwrights, two motorcycle orderlies, and one cook.

The driver of one of the heavy trucks.

in a letter to his folk, complains that he never knows where he is going. He says that a motorcyclist precedes the first truck of a column, and the driver of that truck has orders to follow the cyclist. The other drivers, of course, "follow the leader." one occasion the whole convoy made a rush trip which lasted, with few stops three whole days.

Signal Troubles.

The old-fashioned signal "halt" called by a sentry on the roadside probably will have to be amended in some way. numerous occasions drivers of trucks, motorcycles and swift touring cars have dodged death by a hair's breadth. A dozen or so are reported to have been killed because of the old-fashioued "halt" shouted by a soldier. The sputtering motor downs the call, and the first intination the driver of a car gets that anything is wrong is a rifle bullet singing past his head. Complaints from drivers have caused a change in the challenging along ome of the most frequently used roads. A red lantern is waved, and if the driver does not stop instantly there's apt to be a racancy on that particular truck.

Far-reaching Accidents.

On what slight chances the safety of a hole army sometimes depends was in the early part of September during a French division to another retreat of a French division to another fortified position. There was only a single road of medium width, along which the swift retreat was made. A desperate attack of the Germans in greatly superior numbers was launched at this point, and the whole division took to the motors for rapid withdrawal. At the high speed made, one of the big trucks near the head of the column skidded and upset, pitching its load of heavy cases of ammunition into the road and blocking it completely for all vehicles. It took forty-five minutes to clear the débris, and in that time the German artillery dropped hundreds of shells into the surging mass on the road. Fourteen heavy trucks had to be abandoned. after having been rendered useless by removal of important parts. Almost a thou-sand men were killed and three times that number wounded-all because a truck skidded at the wrong time

In another case reported from Belgium. motorcycle orderly guiding an ammunition train to its destination was struck by a small piece of shrapuel in such a man-ner as to make him lose control of the wheel. He crashed into a tree on the wayside and was knocked unconscious. accident happened shortly before a cro road point, and the motor column empted to go ahead without the guide. The wrong road was chosen, and the colmn brought up a half hour later at the field kitchen station belonging to another army corps. Nearly ten miles away a regiment was out of ammunition and had to withstand a withering fire from the enemy without being able to reply ef-

The Rubber Tire Problem.

Except on the fast cars used by the officers, pneumatic tires are strictly tabooed. Even on motor ambulances the solid rubLEGAL NOTICES

If you have an invention which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of more than sixty years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to PATENTS, TRADE MARKS, FOREIGN PATENTS, etc. All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

MUNN & COMPANY

361 BROADWAY, NEW YORK Branch Office, 625 F Street, Washington, D. C.

Classified Advertisements

Advertising in this column is 75 cents a line. No set than four nor more than 12 lines accepted. Count even words to the line. All orders must be accomanied by a remittance.

AGENTS WANTED

AGENTS. 500% Profit. Free Sample Gold a Silver Sign Letters for store fronts and office w dows. Any one can put on. Big demand eve where. Write today for liberal offer to ager Metallic Letter Co., 438 N. Clark St. Chicago, U.S

BUSINESS OPPORTUNITIES

A GOOD RELIABLE INSTITUTION was anufacture patented articles on a royalty, or me satisfactory arrangement with the inventhing in the line of brass or electrical good—or we are in a position to finance a anufacturer who has not sufficient capital to manufacture patented articles on a royalty some satisfactory arrangement with the something in the line of brass or electrical ferred,—or we are in a position to finam manufacturer who has not sufficient capit on his business by buying it outright or some other arrangement that might be sto the owner. For particulars, address Box 775, New York.

MARKETING INVENTIONS

IN CONNECTION with the development we laboratories the undersigned is willing to co-yn meritorious inventions ready for the market celally those relating to motor car and meel nes. Address with copy of patent. McCa aboratories. McCormick Mfg Co., Dayton

PATENTS FOR SALE

PATENT ON IMPROVEMENT in W. Meters, particularly that class known as the meter, where disk revolves about center, and has a bearing to prevent any sediment settling. Add Charles Urkevite. 30 Story St., South Boston, M.

ELECTRIC LIGHTING FOR AMATEURS How a small and simple experimental installation can be set up at home. Scientific American Supplement 1551. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

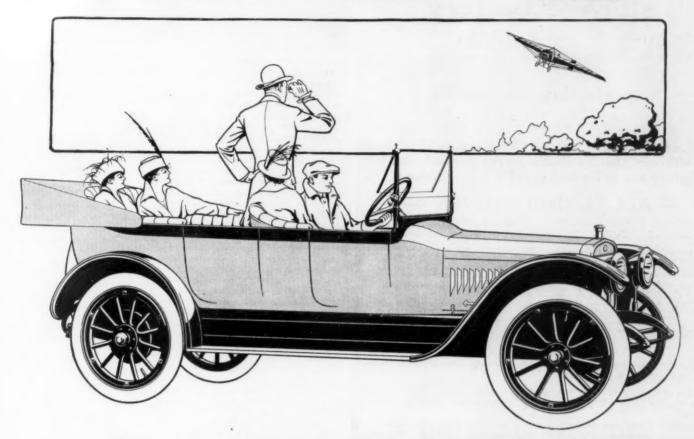








A TOTALLY NEW WINTON



AT A NEW PRICE-\$2285

Excelling quality—never before produced except in the biggest and most costly cars—is now, for the first time, obtainable in a car "not quite so big"—and at a price hitherto impossible:—The New-Size Winton Six at \$2285.

This car gives you everything that makes an automobile high-grade, good to look at, delightful to use, and creditable to own-even to that final note of quality, your own personally selected color scheme.

Here are Some of its Major Features:

Motor—The famous Winton Six-Cylinder L-head motor. Bore, 3 1/4 inches. Long stroke, 5 1/4 inches. Ratio of stroke to bore, 1.44 to 1. Big valves. Spark plugs in head. Fly wheel, crank-shaft, pistons, and connecting rods balanced. Crank-case divided into upper and lower halves. Motor, clutch, and transmission in unit power plant, completely housed.

Wheel Base-128 inches; eight inches shorter than the Model 21 Winton Six.

Electric Features—Bijur starting and lighting system with separate motor, generator, and storage battery. Head, signal, tail, and dash lights. Bosch ignition.

Carburetor—Rayfield, special type. Dash control. Primer on cowl board,

Fuel System—Seamless gasoline tank of 21½-gallon capacity at rear of frame.

Gasoline carried by air pressure to auxiliary tank under cowl; flows by gravity to carburetor. Cleanest and safest system. Main tank has gasoline gage.

Lubrication—Oil circulation by means of gear pump in crank-case. Practically infallible; a system that has made the Winton Six the best lubricated motor in the world.

Cooling—Honeycomb type radiator of large capacity. Cylinders fully water-jacketed. Gear-driven centrifugal circulating pump. Radiator fan.

Clutch—Five-pair dry-plate clutch. Highly effective in operation, and easily con-

Transmission—Selective sliding gears; four ahead and one reverse. Direct drive on third. Lockout on reverse.

Steering—Left-hand drive, with center control. Worm and gear steering mechanism. Self-lubricating bushings.

Drive—Drive shaft has internally lubricated universal joint at each end. Spiral bevel gears in rear axle.

Axles—Elliott type drop-forged front axle. Full floating type rear axle.

Springs—Chrome vanadium steel springs. Semi-elliptical front. Three-quarter elliptical rear. Rear springs underslung. Dann oil-cushionized inserts in all springs. Resilient and squeakless.

Wheels—Wood or wire wheels at purchaser's option. All wheels run on Timken roller bearings.

Brakes -Two contracting and two expanding brakes of liberal size, all on rear

Tires and Rims—36 by 4½ inch tires on all wheels. Non-skid tires on rear wheels. Firestone demountable rims. Tire Inflation-Motor-driven air pump provides pressure for tire inflation

Accessibility—To make all working parts quickly accessible has always been the Winton policy. That policy has been thoroly observed in this model.

Body—The American Beauty type, a creation that makes this a genuine pleasure car. Especially graceful in design, and the last word in comfort. Divided front seats without extra charge, if you desire them. Spacious doors on concealed hinges. Finest of coach leather. Information upon request about roadster, coupe, limousine, and other bodies.

Top—One-man top of silk mohair, with handy Jiffy curtains that are put up or taken down without alighting from the car. Top attached to glass front.

Wind Shield—Handsome and sturdy. Fine plate glass. Both sections adjustable; upper for rain vision, lower for ventilation.

Equipment—In addition to features named above, the equipment includes Warner speedometer, clock, and Klaxon horn. Latter is carried out of sight, under the bonnet. Horn button in center of steering wheel.

Colors—To avoid the monotony of cars that lack distinction and individuality, we permit the widest range of color schemes on this car. Each buyer may have his car finished to suit his individual taste. Metal parts trimmed in nickel.

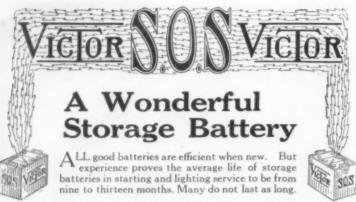
Service - Buyers of this car will be entitled to the same thorogratuitous service that is extended to buyers of the Model 21 Winton Six. That means continuous

Price-This car, which we term the Model 21A, sells at \$2285, f. o. b. Cleveland.

Completely descriptive catalog upon request

The Winton Motor Car Co.

1080 Berea Road, Cleveland, Ohio, U.S.A.



Experts Say Impossible

A prominent manufacturer of starting and lighting systems recently said a battery giving even 5% more efficiency would be almost revolutionary.

Victor S. O. S. Batteries will give 25 per cent. to 50 per cent. more efficiency After Six Months' Service than any other lead plate battery now on the market, and their life is twice as long

- ALL CLAIMS PROVEN

follows:

WAS OVERCHARGED AND OVERHEATED AND ENTIRELY DISCHARGED WITHOUT ANY INJURY WHATEVER. (This
was done not once but many times.)

STOOD IDLE FROM DEC. 12th, 1913.
UNTIL APPIL. 1st, 1914. RECEIVING NO
CARE WHATEVER DURING PERIOD OF
IDLENESS. AFTER CHARGING IT HAD
THE SAME EFFICIENCY AS WHEN NEW.
(Other batteries must be charged and discharged once or twice a month when idle or
they will be seriously harmed and even ruined
for further service.)

SEVEREST TEST OF ALL

Nov. 9th, 1914, an expert electrical engineer put a dead short circuit across terminals of this same battery and applied a high trans-former test to reverse polarity of battery. After having same on for more than one minute battery was tested with a meter and found to be in first class condition.

The battery was then disaseffect on the plates.

PLATES SHOWED NO SULPHATION AND HAD NOT BUCKLED OR CRUMBLED IN THE SLIGHTEST DEGREE. THIS TEST IS THE MOST SEVERE TO WHICH A STORAGE BATTERY CAN BE SUBJECTED.

CAR MANUFACTURERS. A starting and lighting system is no better than its battery. TEST A VICTOR S. O. S. YOURSELF

DEALERS. A VICTOR AGENCY WILL ENABLE YOU TO POSITIVELY CONTROL LOCAL BATTERY BUSINESS. Write or wire for proposition. Im

THE LIFE OF VICTOR S. O. S. BATTERIES IS TWICE THAT OF CAR OWNERS. OTHERS AND EFFICIENCY DURING LIFE MORE THAN TWICE. YET THE PRICE IS NO MORE. OUR LITERATURE IS INTERESTING. A postal brings it.

VICTOR S. O. S. BATTERIES FOR STARTING AND LIGHTING, LIGHTING, HOUSE LIGHTING AND IGNITION.

VICTOR STORAGE BATTERY CO., 2300 Fourth Ave., ROCK ISLAND, ILL.







The Three Great War Numbers SCIENTIFIC AMERICAN

THE PRICE OF THESE NUMBERS IS 25c EACH. THEY ARE INCLUDED IN THIS

SPECIAL TRIAL SUBSCRIPTION OFFER

Sixteen numbers of the Scientific American and three War Numbers, 25c each, all for

Munn & Co., Inc.

One Dollar

Every issue of the Scientific American from now on until the end of the War will contain authoritative illustrated articles on the War and the progress of the contending Armies and Navies.

Clip and fill in the coupon now. Send it with \$1.00, mon or postal order. You will want to preserve these imports numbers of the Scientific American.

One year (52) numbers including War Numbers, \$3.00 MUNN & CO., Inc., Publishers

361 Broadway New York City MOTOR CAR RESOURCES,*

Type of Motor Car	Great Britain	France	Russia.	Belgium	Servia	Ger- many	Austria- Hungary	Turkey
Armored Cars	500	500	200	50		1,000	300	100
Subsidized Trucks		1,200	300			1,400	600	
Other Heavy Trucks	18,000	15,000	500	200	50	15,000	3,000	300
Gun Tractors	150	300				500	200	
Touring Cars Available.	250,000	95,000	15,000	10,000	100	60,000	20,000	500
Special Army Vehicles.	******	300	100	50		1,000	500	

nese figures have been compiled from the latest available official statistics, combined with ed new production by companies under military control; estimated waste of the first four of the war, calculated on the basis of 30 per cent of the total in use in September; and the disciplinary of the supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain, Russia supplies of British cars to Russia and American cars and trucks to Great Britain Russia supplies of British cars to Russia and American cars and trucks to Great Britain Russia supplies of British cars to Russia and American cars and trucks to Great Britain Russia supplies of Britain Russia and Rus

the British armored cars twin pneumatics lighter, stiffer and less liable to the whipare used on the rear wheels, but in the ping which may constitute a grave evil majority of cases solid tires have been Safety in this case is preferred to a certain degree of comfort.

In one of the dispatches sent by Gen. French to the British government, em phasis is laid on the necessity of having enough spare tires for all sizes of wheels. A whole fleet of trucks had to be abandoned and scrapped during the wild cramble across northern France because there were no extra tires for the trucks! Motor truck experts now at the front calculate the destruction of vehicles at about 60 per cent of the total, figuring that not more than 40 per cent of the motor trucks sent to the front will ever return in condition to be useful for anything else. The estimate of the British is slightly higher, reaching nearly 70 per cent, while that of the Germans is less than 50 per cent. Several hundred good British and more than a thousand French and Belgian trucks are reported to have been repaired by the Germans in the big F. N. and Minerva auto-mobile factories in Belgium. The Minerva plant, especially, has proven of great value to the invading army, because of its location at Antwerp, so near the scenes of

Special Equipment.

Among the special types of vehicles em ployed in the campaign are a number 200 horse-power motor plows which dig renches three feet deep faster than a hundred men can dig them with spades. Huge steam tractors with regular roller wheels for smoothing roads are used for pulling heaviest weights, while caterpillar tractors, of the type made in Iowa and Illinois, pull the heaviest siege guns

Searchlight wagons are used extensively, some with acetylene and some with electric lights; powerful trucks equipped with electric dynamos for charging wire entanglements with high-voltage electricity; aeroplane towing and repair wagons; swift, small mall delivery wagons, "cyk-lonettes" on the German side; light four-wheelers on the side of the Allies.

Military tactics to-day may be said to rely pre-eminently on the motor and its speed. Attacks reaching forward at the rate of thirty miles a day are no novelty in 1915. Retreats, in complete order, at a speed of fifty miles a day would have been called impossible by military men twenty years ago. The motorcar has revolutionized warfare. In its complete de-struction of all the lore of centuries regarding military tactics it has proved as ruthless as the much talked of 42-centi neter siege gun of the Germans has to the fortresses of the past century.

The Car of 1915

(Concluded from page 10.)
of counter-balancing his crankshafts.
This lightening and balancing has come as a matter of course, for it is absolutely in view of the higher piston

worthy fact that it costs less than one systems using more material to obtain a similar result, has brought it to the attention of the industry.

These are some of the things that distance of 1915 from the car of

that may come, however, that one maker has adopted a type in which all gears not in use remain idle and not idly rotating, as is the more usual custom. This, of course, reduces both power waste and wear, and may, therefore, be looked upon as commendable. Disk and cone clutches hold about their accustomed places in sound engineering principles,

ber tire is preferred, because of the im- popular esteem, but there has been a notmense trouble caused by bullets or shrapnel penetrating the pneumatic—usually at the most inopportune moment. On some of instead of solid. Hence, they are at once



in some of the modern long wheelbase vehicles.

In methods of final drive, the worm scarcely has made any advance, though one maker has adopted it during the year. In the commercial vehicle and electric passenger vehicle fields, however, it steadis coming into more extensive use. But in the gasoline pleasure vehicle field the combination worm and bevel gear, or, as it is styled, the spiral bevel gear, answers practically all of the requirements of the worm gear, but offers few if any



Spiral bevel gear.

of its disadvantages in the way of manufacturing difficulties and mounting prob-

Still another place where the promise of last year has been lived up to is in the spring suspension. The cantilever type of spring, which last year first became all common when a number of makers adopted it all at once, has become still more common and now has taken a firmly intrenched place in the industry.



The cantilever spring.

monstrated efficiency, coupled with the

as a matter of course, for it is absolute essential in view of the higher piston.

These are some of the tings that essential in view of the higher piston tinguish the car of 1915 from the car of the tinguish the car of all. They are In gearsets, not a great deal of change is noticeable; it is significant of changes a following out of the various tend-that may come, however, that one maker

(Concluded from page 11.)
discriminating selection of materials, and the very highest grade of engineering skill and workmanship throughout.

It is this very high standard of manufacturing required, combined with the old, long-recognized dislike of Americans for high speed motors, which makes automo-bile builders hesitate about adopting them as a regular feature. The Frenchman, with small output and skilled hand labor, can maintain this required standard with-out much difficulty, but to accomplish it on the scale of the American factory out-put is a far different thing and calls for much preliminary work and experiment before it can be safely launched upon the

As regards the four principal features which must be considered in the manufacture of the high speed motor, that of suitable valve mechanism is probably the most important as well as the most vexing problem confronting the engineer at the present stage of development. In fact, it is undoubtedly true that this type of motor really waits at present upon the satisfactory solution of the valve mechanism more than anything else from an engineering standpoint.

We are in the midst of the melting pot era on valve design, when every conceivtype of mechanism from modified poppet style to so-called sleeve, rotary and piston types is being experimented with, adopted, or advocated. There is much confusion of ideas among engineers as to the relative merits of each, because all types have not been tested enough yet under actual service conditions, and particularly under high speed requirements, to promote confidence as to their thorough practicability. Furthermore, the introduction of the sleeve, rotary and piston valve types complicates the matter by the direct relation they have had upon the lubrication problem. If such valve mechanisms are adopted a delicate adjustment of lubrica-tion must be provided to prevent excess accumulation of oil on the ports at slow speeds and oil starvation at high speeds. The range of motor speed being greater, the difficulty of such lubrication is much increased over that encountered on relatively slower-speeded motors.

The ordinary poppet type of valve af-fords a much simpler problem as regards lubrication, but has two serious draw-backs for high speed use. One of these is its smaller relative port area, which tends to cause strangulation of the entering charge as well as of the exhaust gases, and hence reduces efficiency. The other is the risk of actual fracture of the valve stem and consequently serious motor damage due to the terrific hammering acdamage due to the terrific hammering action of this style of valve. This type is also more difficult to keep in adjustment on high speed work. Few people walk on high speed work. Few people realize how great this strain is in poppet valve action. At a speed of 2000 revelution action. At a speed of 2,000 revolutions per minute of the motor of four-cylinder design each valve must be jerked from the standard of interchangeability of parts than heretofore, and in fact the repair men will also come in for section of the standard of interchangeability of parts than heretofore, and in fact the repair men will also come in for section of the standard of interchangeability of parts than heretofore, and in fact the repair men will also come in for section of the standard of interchangeability of parts that the standard of interchangeability of parts t design each valve must be jerked from its share of responsibility when it comes to seat, raised, say, $\frac{1}{2}$ inch, and dropped again through the same distance one thousand times in a minute. The actual time used for the complete opening and closing into the combustion chamber or resort to any other of the numerous tricks familiary for the control of a second, and it is this high frequency of a second, and it is this high frequency of successive hammer blows which finally causes rupture of the valve stem, even though the blows are small relatively in intensity. Also the alternate heating and ancing standpoint. when the small, quiet running motor of the exhaust valve, has a deteriorating effect upon the strength of the latter and hence upon the strength of the latt shortens its life. These two valve destroyers have their most powerful effect in the high speed motor on account of its extreme properties in all directions, and it is therefore easily apparent why the valve mechanism must be very carefully worked out and given a most searching test before adoption as a standard product.

features are satisfactorily disposed of we tion in weight is secured. This weight are not likely to see any extensive manured control of the line with

The High Speed Automobile Motor facture of this type of engine, however

desirable it may be.

The matter of balance has already been pretty thoroughly met and the rules to be followed are more or less generally understood by all automobile engineers. introduction of forged steel piston rods of very uniform size and light weight as well as of composite aluminium pistons has considerably simplified this problem of late. In high speed work kinetic balance is of very great importance and the old methods of balancing according to static principles are no longer sufficient. For instance, a flywheel when mounted on a shaft and set on knife edges can be balanced statically without great difficulty by merely drilling into the side of the rim of the heavier portion, but this does not give any assurance that the center of gyration will coincide with the axis when it is re-volving. To secure a sufficient approximation to the latter ideal condition necessi tates a very careful testing of all the revolving and reciprocating parts. Failure to maintain this high standard of balancing practically eliminates the motor from bid for success in the high speed field, for its balance must be so perfect that its real motor speed cannot be readily detected. The slightest unbalance produces vibration, which in turn attracts the attention of the occupants of the car to the speed of revolution of its motor. To be a real success, the latter must be literally unobtrusive as regards noise and vi-

Much of the success of the balancing problem depends upon the skill of the designer in proportioning the relative parts and selecting the materials, so that no useless metal is present in the rotating or The proper comreciprocating members. bination of strength with lightness in such units as the pistons and connecting rods, crankshafts, etc., is of the utmost impor-tance, and of course the lighter these parts can be made the easier the balancing problem becomes. From the very nature of the design the parts of a high speed motor of equal power to one of much slower relative speed ranges can be made considerably lighter, for the necessary in-crease in power is obtained by the greater speed of the motor, and the piston and bearing pressures are therefore less.

The common practice of balancing by merely paring off component parts, such as opposed pistons, will not suffice for high speed standards. Such an arrangement is liable to produce a disagreeable fore and aft traveling or periodic vibration along the crankshaft and is a make-shift arrangement at best. Each piece must be weighed, inspected and sorted, with the object of maintaining the dupli-

overhauling such motors. It will never do, juvenate wornout motors. A little careless work of this character would ruin the finest built high speed motor from the bal-

duct.

It is of course only a matter of time accustomed to. On account of the higher before a thoroughly satisfactory valve mechanism will be developed for this style of motor and combined with an efficient of the shorter wheel base possible from olling system, but until these two vital features are the same of the shorter wheel base possible from this compact design a still further reductive to the shorter wheel base possible from this compact design a still further reductive to the shorter wheel base possible from this compact design a still further reductive to the shorter wheel base possible from the shorter wheel base possible



The cream of the automobile industry uses "Barreled Sunlight" in their plants.

Test it out yourself, under our guarantee

You can easily prove to yourself that Rice's Gloss Mill-White will give 19% to 36% more daylight; will save you money in making repainting less frequent; will not crack or scale; and will be more sanitary.

Apply Rice's in a section of your plant, where a fair comparison can be made with the interior finish you now use.

It stays white longest

Rice's Gloss Mill-White is the original "mill-nite." All others are imitations. It is the only mill-white which contains no varnish. For that reason we guarantee that if Rice's does not remain white longer than any other gloss paintapplied at the same time and under the same conditions—we will give, free, enough Rice's to repaint the job with one coat. We also guarantee that, properly applied, Rice's will not flake or scale. You cannot lose under this guarantee.

Over 3,000 firms use and praise this interior

Can be applied over cold-water paint

Hundreds of factories where cold-water paint was formerly used have thus been treated with Rice's Mill-White and the flaking and scaling nuisance permanently obviated. Not only has a double surface thus been produced, but a tile-like smooth finish which can be kept clean and which also reflects light and WILL NOT SCALE.

RICE'S GLOSS MILL-WHITE

Rice's Granolith

For Concrete Surfaces

Sold direct—write us for booklet and sample board

Sold direct from our factory in barrels containing sufficient paint to cover 20,000 square feet—one coat.

U. S. GUTTA PERCHA PAINT CO.

23 Dudley Street

Frovidence, R. I.

The Postal Life is the Company of Safety and of Saving

A FINE feature in the growth of the Postal Life Insurance Company is the friendliness expressed in daily letters from satisfied policyholders—the Company's best asset.

Postal policyholders are friendly because they are satisfied, and they are satisfied because they know that the Companytheir Company—is safe, and also that it saves them money.

Safety

The Postal is safe be-use it sets aside the full serves required by law and necessary for the payment of all policy-claims, now and in the

In addition to this legal reserve — now more than \$5,000.000 invested in interest-bearing securities—the Postal carries a surplus and has ample funds at interest in leading banks, and a special of \$100,000.00 State of New tre the Company red.

nn

Though less than teners old, it now paysnd promptly—more
han a million dollars
year to beneficiaries
troughout the Union and
sewhere, under policies
sued through the Com-

POSTAL LIFE

Saving

The Postal Life saves for its policyholders through its economical management. The scientific application of hygienic principles through its Health Bureau also prolones the Bureau also prolongs the Bureau also prolongs the twerage life of policyhold-irs, resulting in decisive avings in mortality.

It is the only American Company that does not employ agents, but gives its policyholders the bene-fit of the savings from commissions that other aying p

nn By doing business direct with the public through advertising and correspondence, the Postal Life does away with numerous branch offices throughout the country and various unnecessary State requirements—two very investments and in the country and the coun

The Postal is thus not only legally and scientifically safe, but it made doubly safe because it saves where other companies must spend.

Find Out What You Can Save

s Official Booklet, "SOUND INSUR-icial figures for your own age, on

It will pay you to write to-day for the Company's Official Induced Protection at Low Net Cost," also official figure any form of policy—Whole-Life, Limited - Payment Life, Endowment, Joint-Life, Child's Welfare, or a Monthly-Income Policy. The Postal issues all the standard forms and all these are approved by the strict New York State Insurance Department.

"Mail insurance particulars as per SCIENTIFIC AMERICAN for January 2, 1915"

lust write and say:

And to find out how much you save, be sure to give:

1. Your full name. 2 Your occupation. The exact date of your birth.

S for your own age, on STRING POSTAL POINTS I STRONG P

No agent will be sent to visit you. The commission-savings thus resulting go to **you** because you deal **direct**.

Postal Life Insurance Company

WM.R. MALONE, PRESIDENT (Thirty-five Nassau Street, NEW YORK)

More Power 6H 59875 Less Money 6P.

My New 1915 Proposition

LEARN TELEGRAPHY MORRE and WIRELESS at home with OBNISHARY
AVIOUS ATTE TRACEMEN in half usual time-terfing
costs. Sends you messages without limit actomatically—easily become appert. Price Syru
Catalog free. OMNIGHAPH MFG. CO.
Dept. M. 95 Curtands Street, New York.

Whittelsey-Ford Carbureter Adjuster An attachoole, adjustable, dash, carbureter adjuster to use Ford Car, that will enable FORD CARS TO RUN THE

31 MILES TO THE GALLON which the Ford Company has built into them. Easily attached, on indipensable help to every Ford. Remove the guessing, enables quick and positive carbureter adjustments by any Ford owner. Makes starting easier, running better and Sauces Gasodines. Full instructions. PRICE \$1.00 Prepaid. Send for in oww. We guarantee satisfaction or money refunded without quibble. DEALERS! This is the guarantee Ford Leader ever offered. You should carry them.

WHITTELSEY CO., Dupt. II, 11 Broadway, NEW YORK

THE EDISON CONCRETE HOUSE

How it is constructed, how much it will cost, is it practical from an architectural and engineer standpoint? These and other important question standpoint? These successed in a good, thorough, illustrated article published in Scientific American Supplement 1685. Price 10 cents by mail. Order from your newsdealer or from

MUNN & CO., Inc., Publishers, 361 Broadway, N.Y.

At Bargain Prices= 150-6 volt, 12 Ampere Dynamos

r, high-grade, guaranteed, ery charging, low voltage we ourposes, automobile or moto

The ESTERLINE Co., 235 E. South St., Indianapolis



a total amount that will prove a strong'road in which three counties were vitally interested, the cost of improvement of who has become tired of the constantly which would not be less than \$7,000 per cent years. have a particularly strong appeal when it value. The entire road must be improved is further realized that the same power is as a single unit. The State-aid allotment still available in an even smoother drive available that year for each county was than formerly with the slow speed type, set aside for this road with the underand fully as much, if not more, room and comfort. At ordinary car speeds a four-the additional funds required. In Albecylinder motor of the high speed type marle County a portion of the funds was should very closely approximate the raised by private subscriptions by the smooth torque of the six-cylinder motor citizens and the county appropriated the and afford a drive entirely free from the objectionable jerking and bucking of the large high-geared four-cylinder type when the latter is throttled down finely. stant tinkering and tuning up would not be as necessary on this type either, as an occasional skip would scarcely be noticed except when the motor was well loaded

Another important feature not often entioned in analyzing the principal characteristics of the high speed motor is its valuable braking property. Anyone who has ridden in the front seat of a taxicab the driver must have observed how readily these little cars slow down by erely closing the throttle and leaving the clutch in. The great value of this feature the simplicity of control afforded by using and lacks the proper co-ordination with well-nigh exhausted at the end of a day's running if he had to release his clutch and apply either the foot or hand brake every time he slowed down. In the touring car with high speed motor and comparatively low direct drive gearing this motor braking property would be even more pro-nounced than in the ordinary type of taxicab and would greatly simplify car control particularly for new drivers.

When looked at from all angles it would nation. appear that there already exists a strong under-current of opinion among motorists favorable to the commercial exploitation of the high speed motor type of car; not for the sake of the high speed motor itself, but because of the relief which it eems to promise from the constantly growing burden of weight and increased running expenses. Its successful develop ment, however, must wait the solution of manufacturing difficulties, and there is evidence that American manufacturers are now working to gradually evolve a motor which will meet these high speed

How Small Communities May Have Good Roads

(Concluded from page 15.)

who have charge of all the public roads, that if the Commercial Club would pay all costs over and above that of drainage and grading, they might proceed as they wished on any piece of road, not to ex-ceed one mile in length. It was decided to select one of the worst sections and improve it as an object lesson of what could be done with available funds and mate-A road expert was secured from the Office of Public Roads to make the detailed plans and supervise the work. typical of the worst road problem confronting that region, a road was selected which for several months of the year was practically impassable, because of lack of subdrainage. This road was properly drained and surfaced with gravel. striking and convincing was the object leson that before the expert had entirely completed the work, the county super-visors were calling for contracts involving the drainage of several thousand feet of road in the vicinity.

A State Department Promotes Co-oper-

ation.

In the Blue Ridge Mountains of Virginia, a road 14 miles in length passes through three counties. Eight miles are located in Albemarle, four miles in Austa, and two miles in Nelson County. This road had long been in need of improvement, but because of the three distinct jurisdictions, no concerted action toward the battle front. Destroyed

easing weight of touring cars in re-years. This feature we believe will provement would be of but questionable remainder. In Augusta County the county authorities appropriated the necessary funds, while in Nelson County the entire Con- local fund was raised by popular subscription. The State prepared the necessary plans and supervised the construction. This road was thus built through the co operation of the State, the counties, and rivate citizer

Administrative Organization Essential.

Whether co-operation in road work among smaller communities will be efficient and prove of real and lasting value or but a costly experiment, depends largeon the administrative organization. Haphazard co-operation cannot be too severely condemned. It invites extravagance and is inefficient in the expenditure of is better appreciated when one considers labor and funds. It works without system the throttle for retardation as well as for acceleration. A taxicab driver would be State. But, on the other hand, properly organized and directed co-operation furnishes a means through which local communities may secure better systems of road management, more efficient returns from their road expenditures, and better This kind of co-operation will give them roads which are adapted not only to their own local needs, but also adapted to meet all the requirements, both present and future, of the county, State, and

War Experiences of an Air Scout

(Concluded from page 20.)

siderably faster in speed, and capable of climbing 7,000 feet in fifteen minutes, thus making it a very desirable machine for scouting purposes as well as to give fight to any of the German machines, some of these machines were equipped with machine guns operated by the pas senger, while others were fitted with bomb-dropping devices. It is excellent also for observation work and the dropping of small round, pointed, and grooved iron pencils in quantities of a thousand at a The latter proved very efficient when dropped over the enemy on the march or into their trenches.

Off to the Battle Front.

On October 17th I received the long-looked-for order to go to the front in an escadrille of six Morane-Saulner mo That night five other pilots and planes. myself left Tours for Saint Cyr, a few miles outside of Paris, where we found the six Morane-Saulner machines awaiting our arrival the next morning. The six of us visited the captain in charge at Saint Cyr, who ordered us to fly that day to the aviation headquarters near Arras, 150 kilometers from Paris. Maps were furnished us, which we prepared and placed in the map cases which are n part of every machine, as well as a compa with which every apparatus in France is steered. A flight of ten minutes demon-strated to me that my apparatus was in perfect condition. At one P. M. on the 18th of October the six of us started at a few seconds intervals on our journey. Upon attaining a height of 2,000 meters, the six of us sailed from Saint Cyr toward the point where civilized men were murdering each other, and the fact that it would be but a matter of a few hours ere we would be accomplishing the same purpose with our deadly bombs seemed hardly bélievable.

The journey, a short one, seemed awfully long to me. Several times, with the aid of field glasses, I could see far below me thousands of soldiers marching was reached until the State Highway De-partment pointed the way. Here was a showed me ground that had been occupied

ADVERTISING CLASSIFIED

ENGINES



id

ce of

th

ly r-

ns er

nd

ht

th

nt

nd

six

ay as,

irt

is

in

at

ily

ar



6c for 10 Hours

ELLIS ENGINE CO





Magical Apparatus



MASON'S NEW PAT. WHIP HOISTS save expense and liability incident to elevators. Adopted by principal storehouses in New York and Boston Manufactured by VOLNEY W. MASON & CO., Inc. Providence, R. I., U. S. A.

VEEDER Counters 99728 VEEDER MFG. CO.
Sargeant St. Hartford, Coon.

by the Germans a few weeks before. After flying for one hour and a half the portable hangars of the temporary aviation headquarters just to the south of Arras appeared visible. A few minutes later I was directly above them. Shutting off the motor I volplaned down in a spiral glide, and a few seconds later was again on terra firma. The six of us had made the flight of 150 kilometers without mishap. I was anxious to get into the fray at the earliest possible moment, so I immediately reported to the commanding officer, who appointed a junior officer to ac-company me as observer on my flights; the first to be made the following morning

Patrolling the Sky.

at six o'clock.

The next morning at six o'clock my observer, who was able to speak good English, and I were up and anxious to fulfill the work that lay before us. A heavy fog was a great disappointment to me and caused a delay in our start. It was at least ten o'clock before the captain would permit us to start away on our flight. Our ourse had been prearranged, and it was the duty of my observer to make notes of the movements of the enemy's troops. Several other apparatus started away at the same time we did. Rising to a height of 2.250 meters (7.000 feet) I headed the machine toward Douai and thence toward Lens. The flight lasted a little longer than one hour, and proved to be intensely exciting. At times it was impossible to ee the earth directly along the line of battle, owing to the terrific cannonading was going on; the smoke was so den that it seemed as though we were flying above the clouds. We penetrated the enemy's line for a distance of half a dozen miles, where the actual movement of troops was going on, the data on which was quite important to the French. There appeared vast columns of soldiers that, in the winding roads, seemed like great big snakes crawling slowly along. From our extreme height it was hardly possible to make out the direction the troops were traveling; but after circling over the point for ten minutes, my observer detected with the aid of glasses the direction in which they were heading.

The Death Dealing Arrows.

In one hour of flying the observer who accompanied me had sufficient time to note nearly every action of troops belonging to the enemy that we had flown over; and upon alighting his notes were immediately dispatched to the front. Three mb-dropping machines and one equipped with several thousand of the sharp-pointed, steel arrows, or pencils, as they are sometimes called, were dispatched to raise havoc with the enemy's troops that were on the march. For this purpose the steel arrows, which are about 41/2 inches long round, and sharp on one end, and grooved out on the other end, prove a very good weapon. They are dropped from the aeroplane while in motion in quantities of 1,000 at a time. They spread out over an area of 300 square feet, and after a fall of say 6,000 feet, they will penetrate almost anything. The French were the first to invent their and the Germans, seeing their good work through the damage done to their own men, copied them with the following words cast thereon: "Invented in France, but made in Ger-

An Aeroplane Lost.

Of the four machines that started out on their murderous journey to the enemy's lines, one did not return. He suffered the same fate that he and his passenger were dealing out to the Germans below. From one of the other three aviators who had accompanied the unfortunate, I learned that he was a young officer, and being very desirous of making a good showing, had, upon reaching the enemy's line, de-scended to quite a low level, where he attempted to dispatch with better accurattempted to dispatch with better accur-acy the bombs he was carrying. Terrific rifle and machine-gun fire was immedi-ately directed upon his apparatus, which suddenly began to wabble and then plunged head first down to a horrible death. Both the pilot and passenger must have been instantly killed, and the horror of having seen his fellow pilot killed

How Many Hides Has a Cow? SOLE leather is not adapted to soft, tufted upholstery of automobiles and furniture. Hides must be split into thin sheets to produce upholstery leather. The two lower, fleshy, grainless sheets are coated, embossed, and sold as "genuine leather." That is why so much "leather" upholstering cracks, rots and peels so quickly. ABRIKOLD MOTOR QUALITY Is Guaranteed Superior to Coated Splits It averages twice the tensile strength of coated splits, is waterproof, and perfectly parallels the appearance and "feel" of the best quality of grain leather. For two years several leading makers of automobiles have been upholstering their cars with it, and are entirely satisfied. Get Acquainted. Small Sample Free. Large Sample (18x25 inches) 50c Du Pont Fabrikoid Company Wilmington, Del. Canadian Branch, Toronto, Ontario Craftsman Quality Fabrikoid on Sale by John Wanamaker, Philadelphia; McCreery & Co., Pittsburg; J. & H. Phillips, Pittsburg; JohnShillitoCo., Cincinnati; Stix-Baer-Fuller Co., St. Louis; Du Pont Fabrikoid Co., 621 Broadway, New York

Save Money with Oxy-Acetylene Welding and Cutting

EVERY live garage, machine or repair shop owner and manufacturer can use this process to wonderful advantage.

Instant repairs to worn or broken equipment, making it good as new, avoiding expensive delays and replacements and cutting production costs, mean money saved and bigger profits.

Cost of necessary equipment is low. We furnish a thoroughly high grade welding apparatus for \$60, not including acetylene cylinders, which are furnished under a liberal service agreement. Truck and special equipment for cutting operations at extra cost.

PREST-O-LITE Dissolved Acetylene

Prest-O-Lite Acetylene Service furnishes the highest grade of Dissolved Acetylene in portable cylinders, used as conveniently as you use cylinders of oxygen. Saves the large initial outlay and heavy depreciation, trouble and inconvenience of making crude Acetylene in carbide generators. Besides, Prest-O-Lite Dissolved Acetylene is perfectly dried, cleaned and purified—makes better welds and is cheaper to use.

one in the metal trades should know the possibilities of the Oxy-Acetylene process wn line. Our free literature explains thoroughly. Your name and address on the margin page will bring you full information—or, better still, put your problems in detail up to pineers. Do it NOW.



If you use Acetylene for ANY purpose, get particulars of PREST-O-LITE Service. THE PREST-O-LITE CO., Inc.

810 Speedway, INDIANAPOLIS, IND.
Direct factory branches and charging plants in principal industrial



Don't forget to have the piston rings examined. They have a very important bearing on motor efficiency.

Perhaps you've noticed poor compression, power shortage for hill climbing or heavy road work, excessive carbon deposit in the cylinders, back-firing, a "knocking" engine. You couldn't tell why, but things seemed to go wrong even though everything

appeared to be right and tight, and you didn't have those troubles when the car was new.

You didn't think of piston rings. They don't seem important, but they are. You'll find yours are worn, badly fitting and with such poor or unequal bearing as to leak compression at every stroke. These faults are sure to develop in the ordinary piston ring after a short period of service. None of them will occur in



Piston Rings

Made by McQuay-Norris Mfg. Co.

This is a two-piece ring so designed and constructed as to make gas leakage impossible. Their use ensures

FULL MOTOR POWER—Because being two-piece, expansion openings are properly sealed. The halves expansion openings are properly sealed. The halves are interlocking and concentric with opposing centers of expansion so that uniform tension on the cylinder wall is always secured. This is the distinctive and patented secured. It means perfect com-

MINIMUM CARBONIZATION—Because surplus oil cannot get up into the combustion chamber either through or past the ring. It is the burning of this il that creates carbon deposit.

SERVICE—Because they are made of special Processed Gray Iron of wonderful toughness that never its elasticity and will outlast the motor.

STRENGTH-Because the construction of the sections on the angle-iron principle gives them the reatest strength.

OPERATING ECONOMY — Because they make every drop of fuel count and check waste of lubricating oil

MAINTENANCE ECONOMY - Because they do not wear or mar the roundness of the cylinder and prevent the deterioration of lubricating oil caused by condensed gasoline vapor getting into the crank case.

Over 300,000 motors are now equipped with LAN-Room Rings



EASILY ADJUSTED

To protect you from imitations \secondo is stamped on the ring-insist.

Send for Free Booklet

It tells all about piston rings and why you should equip your engine with the Leading. How it will pay you in fuel economy and prolonged motor life. Write for it.

Sold by all up-to-date dealers, garages and repair shops MANUFACTURED BY

McQUAY-NORRIS MFG. CO., 2808-12 Locust St., ST. LOUIS, MO.



New York-1919-29 Broadway at 64th St. at 64th St.

Chicago — Suite 718 Michigan
Blvd, Bldg., Michigan Ave. and
Washington St.

BRANCH OFFICES Kansas City—513 New Nelson Bide, San Francisco—164 Hansford Bide, Los Angeles—224 Central Bide, Dallas—1509 Commerce St.

drove my informant nearly insane. learned that the loss of life among the aviators at this particular line of battle front had been quite severe, and averaged about two a week since the war hegan.

Not having been ordered to do any fly ing that afternoon, I visited one of the battlefields in the vicinity, where fighting had taken place weeks before. I should have liked to visit the present point of fighting, but permission was refused me as all aviators must remain, both day and night, at their headquarters, and see that their apparatus is always in a flying condition, in order to be ready to move at a moment's notice, should the commander receive orders from the front to advance or retreat.

(To be continued.)

American Automobile Coachwork

icluded from page

is given in Fig. 5. When it is desired to open the car the top folds back with little overhang. The windows drop into pockets and are not taken out and put behind the driver's seat with a moral certainty of breakage sooner or later. This particular body has only two doors, but the four-door type is even more popular. The V-front is a feature which might well be copied here on bodies of types other than the cabriolet.

Fig. 6 represents a type of town carriage, also of English make, but French design, in which the comfort of the driver is not considered. The addition of a windshield and top would completely alter the character of the body. The toolbox in the middle of the running board, although countersunk, does not enhance the beauty

In Fig. 7 is seen a touring body by an American coachbuilder. The top disappears completely into the body, there being no visible casing. Unfortunately with this type of top a dust screen is often necessary, thus spoiling the very effect obtained after much expenditure of ingenuity.

The subject of Fig. 8, although of the same general type as the preceding example, is much less successful. If the sidelights were set in the cowl, the front door widened to the size of the rear on and the outlines of both changed, and if the top cover were neater, the body would be quite handsome despite the great handicap of the 26-inch height of the frame from the ground.

In this connection I believe not enough attention is paid to the proportioning of the various spaces on the sides of a tour-ing body. If the following points were observed one would see fewer unsuful designs.

1. Two adjoining spaces should not be equal.

2. Front and rear doors should have the should not be cut out at the back.

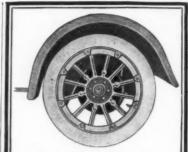
3. The space between the doors should be perceptibly greater or less than the width of the doors.

4. The height of the doors should be percentibly greater (or less, in a two-door body) than the width.

5. The height of the body sides should perceptibly greater than either the height of the frame above the ground or the distance between the top rail of the body and the lower edge of the top when extended.

One would almost believe that the limousine landaulet shown in Fig. 9 is a foreign product were it not for the coach-maker's nameplate. The rear light is admirably large. Except for such details as the rather obtrusive hinges there is very littie to criticise. The same may be said of the clean cut berline in Fig. 10 by the same coachmaker. In this case, however, the hood is not sufficiently tapered, with the result that there is a rather sudden swelling at the dash.

The bodies we have been examining were made by firms conversant with contemporary foreign design. The bodies of American cars, however, are made, as a rule, by the manufacturers of the chassis



It's a Fine Brake, But-

The most powerful looking brake is of little use to you unless lined with 100% dependable brake lining. For if the lining loses its gripping power, your brakes won't work. They may fail you when you need them most.

Brake lining that won't hold size its.

fail you when you need them most.

Brake lining that won't hold after its surface is worn off is a menace to life. See that your brakes are lined with Thermoid. It never will fail you.

hermoic YDRAULIC COMPRESSED Brake Lining - 100%

Brake Lining, to be 100%, must be brake lining all through. Not merely on the outside. You trust it with your life. Hence, it must be trustworthy to the last.

Thermoid retains its 100% gripping power even until worn paper-thin. Hydraulic compression makes it one solid, single substance of uniform density clear through—instead of being loose and stringy (and friction-shy) on the inside, as is ordinary woven brake lining.

No man knows how many accidents

No man knows how many accidents Thermoid might have prevented. Guard YOUR safety with Thermoid.

THERMOID RUBBER CO.

Trenton, N. J.

Our Guarantee: Thermoid Cannot be burned or nor affected by oil, he water, gasoline, dir



Most painters are anxious to do good work. Most painters know the good that

same width, if possible. The rear door does in paint. You are the deciding factor. Do you want the best paint on your houseor don't you?

Our booklet, "Your Move," tells why.

The New Jersey Zinc Company Room 421, 55 Wall St., New York

For big contract jobs consult our Research Burea

Rats and mice eat the meat out of oats and corn and horses get the husk.



RATS ARE DISEASE CARRIERS; CAUSE FIRES. Device resets itself; ready; catches daily. M. M. RATS ARE DISEASE CONTROLL.

RATS FIRES. Device resets itself; always ready; catches daily. Made of galvanized iron; can't get out of order; cheese is used doing away with poisons; 12 rats caught one day in one catcher. One sent any place in U. S. upon receipt of \$3. Catcher 10 in. high, for mice only, \$1. On account of shipping charges being prepaid, remittance requested with order.

Latter of the control of mittance requested w

If we accept this excessive standardizacomfort and convenience. Yet too often form. is not this the case

ould be understood as the mudguards interfere unless the body is kept within the can be lowered almost out of sight, a very It is really unpardonable, how- good point. ever, that the door lights should not open completely.

well powerful enough to compensate for other way would enable more of the run the weight of the glass, may also be cited. The slightest pressure is sufficient to move

We now come to when the company to the property of the company to the glass up and down. Care must be most advanced American stock touring taken not to place the handle near the top body (Fig. 19). Its general lines are good,

jammed against the steering wheels of rear it could be turned from an imitation their cars. If the front seats had a fore and aft motion of only a few inches a tre- reader into a secret. There is a brake mendous increase in comfort would be lever blocking the driver's exit in any

It has two entrances, the one on rearward two inches. the right including the center window, which is narrower than the corresponddows? Why not be logical and drape the case. Compare the relative positions

but is slung far too high above the ground. I well remember that at the last Paris erly arranged ramps approaching the car from the sides, so that would-be purchas- hung appearance despite the very large at the left the driver cannot get out on reducing the gap between body and top his own side. The rear fenders have had the same outline for eight years, so that ators at the base of the windshield, while it is perhaps too late to suggest changing them, but they would really be more effi- is not tapered there is a sudden swelling cient if carried lower down behind the at the dash as in Fig. 10. An aisle sep-wheels. The bonnet, although slightly arates the front seats, a very popular of the full blown convex type.

Windshield stay rods are still retained on the touring cars of this make (see Fig. 13), but are mere shadows of their former The spare tires prevent the top from folding down neatly. The upholstery of the front seat arm, part of which is fastened upon the top rail of the door, should be noticed.

The general proportions of the touring body represented in Fig. 14 are very good. sufficient clearance for American roads the frame need not be swung ridiculously high. The mudguards are very

Almost the only room for improvement lies in the upholstery. As probably no one sits on the doortops why upholster them?

In Fig. 15 is shown a boat body with an aisle between the front seats, which would be very pleasing were it not for the windshield irons, which are brought down far too low. The removal of the radiator

wholesale body builders. The result is that American cars have very little in dividuality, all that is allowed the purchaser being a choice of certain colors.

The body in Fig. 16 represents a considerable advance over those on the 1914 models, but it is far from perfect. It suffers chiefly from a plethora of moldings, especially on the hood and mudguards tion as a necessary evil we should at least The angle between vertical and rounded insist that the bodies forced on the pur-chasers should not be lacking in beauty, cowl, giving the latter rather an awkward

Fig. 17 shows an attempt to build a Take for example the windows in closed difficult body—a domed roofed landaulet. cars. It will almost invariably be found It is unfortunately a failure from the that they open little more than half way, point of view of appearance. The sides If this occurred only in the rear light it of the body are too low in relation to the window height. The rear light, however,

The sedan in Fig. 18 is one of the best looking cars of its type. The roof should Handwheels instead of the old sash and have been slightly more domed, round-peg are now much used for operating the windows. The French practice of fusing molding along the top of the windows, or a small handle upon the glass, and of fitting springs at the bottom of the window in front. Arranging the door to open the

We now come to what is perhaps the of the window as otherwise the glass may the second cowl being very well worked It is unfortunate, however, that on With the individual front seats separ- a four-cylinder chassis of 132-inch wheelated by an aisle now coming into vogue base it was found necessary to cut a piece it would be so simple to make them adjustable. Apparently all drivers of any the driver be compelled to climb over the one make of car are expected to be of front seat passenger to reach the ground? precisely the same height. How often we if the spare tires were moved a little more have seen tall drivers with their knees forward and the front door farther to the The ideal arrangement would be, case! Good points about the body are of course, to have all seats adjustable the high sides, the tumble-in along the top longitudinally, vertically, and as to inclination.

A neat touch not appreciated in the photo-In Fig. 11 a rather novel sedan is graph is the inclining of the windshield

Compare the above body with that shown in Fig. 20, and the improvement ing one of the left. This body has its resulting from concealing the upholstery good points, but mounted on a frame is evident. The front seat in the latter almost 28 inches high it is placed at a disadvantage. As this is a single compartment body why are the beautiful striped curtains confined to the rear wined on similar chassis. Such, however, is them around all the windows?

The body in Fig. 12, a limousine with cab sides, has quite pleasing proportions, the other case he sits on it.

The subject of Fig. 21 is one of the nost powerful cars on the market, and it salon the exhibitor of this make had clev-looks its part. The frame has been dropped abaft the hood, giving it a low ers accustomed to low-hung European pro-ductions would not be overwhelmed. It cism. The sides of the body might with s a pity that with the steering wheel advantage be as high as the hood, thus and hiding the folding seats. The ventil efficient, are not beautiful. As the hood tapered, does not make the slightest pre-tense of merging into the dash, which is better than a sliding or folding front seat, but as it reduces luggage carrying space it is not always desirable where un sary, as in this case

The mudguards are very fine pieces of work. Particular notice should be given to the front ones with the lamp shells and valances in one piece with the guards themselves. The practice of this firm in themselves. mounting the headlamps on the mud-guards has not been followed; 1, because of the difficulty in making the fenders per-It is here seen that in order to provide fectly rigid; 2, on account of the difficulty of refocusing the lamps to suit the individual driver: 3, on the score of appear ance. In this position, however, the lamps can light up the holes in the road and not merely cast dense shadows across them.

In concluding this article perhaps I may be permitted to refer to a sedan body reduced to a minimum not only by the small surface normal to the direction of cap from its usual place strikes the eye travel, but also by the hemispherical shape of the stern, which reduces the vacuum





262 PEARL STREET

You Need Our Catalogue and Equipment



NEW YORK CITY

"American" Drafting Furniture backed by twenty-one years' experience

is right and should receive your careful consideration.

It is being used by thousands of manufacturing concerns, schools and colleges throughout this and other countries, and giving entire satisfaction.

We can meet your requirements in every detail.



Write for our complete catalogue

AMERICAN DRAFTING FURNITURE CO. 200 RAILROAD STREET . ROCHESTER, N. V.

3ammanammanammanammini

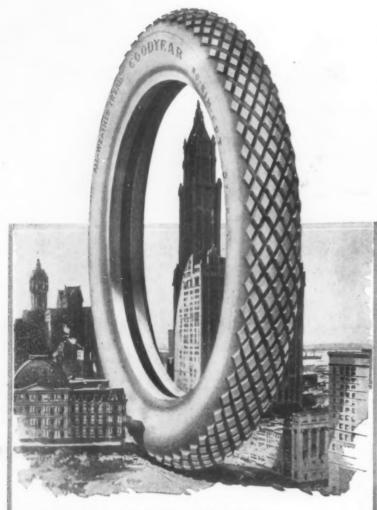
LATHES

At Prices That Will Save You \$50 to \$150

Don't pay high prices for lathes. We will ship you the best lathes of their class made in this country at one-third less than usual prices and will let you be the judge as to their quality. If they fail to give you perfect satisfaction, we return the purchase price and all transportation charges. We have sold lathes on this basis

to users all over the country. Prices from \$63.00 up. Write today for our free Machinery and Tool Catalog No. 70S150.

Sears, Roebuck and Co. Chicago



Look About You-Note How Goodyear Tires

Dominate Every Street

Then consider what tremendous causes have led to that result. Some fifty makers are building tires. Yet this great tire, after millions have been tested, leads in this emphatic way.

Troubles We Combat

This means not only extra-grade rubber and fabric, not care and skill alone. It means that Goodyear excels its rivals in other conspicuous ways. In ways that bring users more freedom from care.

There are five of these ways, and all five are exclusive to Goodyear Fortified

Rim-cuts are combated in the most efficient way that's known.

Safety comes through a Goodyear feature which holds tires firmly to the rim. GOOD YEAR

Blow-outs due to wrinkled fabric With All-Weather Treads or Smooth supply you.

-a major cause-are prevented by our "On-Air" cure.

Loose treads are combated by a patent method which reduces the risk 60

Punctures and skidding are met, as in no other tire, by our double-thick All-Weather tread. It is flat and smooth-running. It is deep and enduring. It is sharpedged and resistless.

You Want Such Helps

You will find these troublesavers-all of them-in Goodyear Fortified tires. Hundreds of thousands en-joy them. You can see the advantage by a glance at these tires, and a test will prove it to you.

Please make that test. We spend \$100,000 yearly in research work to give you the best that's possible.

Let service show you what it means

Any dealer will

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

No-Rim-Cut Tires

behind the car and so minimizes the dust. LATHES AND SMALL TOOLS A segment of the back swings open, giving access to a circular compartment for the This arrangement is, spare wheel. think, ideal as the wheel is completely protected from the elements and does not mar the clean appearance of the car now considered so desirable.

Motorcycling Under Fire

THE present great war in Europe has been called, with a good deal of truth, the Motor War. For the first time in the history of the world gasoline has become factor of the utmost importance in the weal or woe of nations. Never since the invention of gunpowder has war suffered such an upheaval, has the science of war been subjected to such tremendous changes, as in the year of grace 1914. Textbooks on military tactics more than ten years old are as obsolete to-day as if they had been written previous to the discovery of steam and the transportation of armies on trains and steamships

In the great glamour which naturally has been thrown around the automobile as the last word in rapid transportation of armies, one is apt to forget the "Little Brother of the Motorcar," as the motorcycle has been so well named. Not even the aeroplane has done as much service in the present war as the omnipresent, pes-tiferous, and yet self-effacing two-wheeler, whether propelled by the sturdy legs of the soldiers or the crackling, rattling explosions of the gasoline motor. There are probably more than 50,000 bicycles in tive service at the "front" or immediately back of it, and yet the newspaperreading public hardly knows there is a single wheel in use. The splendid work single wheel in use. The splendid work of the automobile has overshadowed the less showy but just as important work of the bicycle, while the great usefulness of the motorcycle is but now beginning to be appreciated.

Limited by the manner of its construct tion and the demands for high speed, the motorcycle, of course, has not been heralded as an attacking or raiding medium as the automobile, or as a carrier of provisions and ammunition like the motor truck and omnibus, or as a savior of the wounded during the battle, as some small tricars and runabouts, but in its special field as dispatch bearer and guide, as well as an occasional reconnoitering patrol, it has surpassed the expectations of its users and supporters.

Letters from the battlefields rarely men tion the motorcycle, but occasionally one gets a glimpse of its work in reports by the riders themselves to their favorite de paper or perhaps to one or the other of the great British dailies. In a report vering the action in the Compiègne for est in the early stages of the war in France a British motecyclist tells of the troubles he had. "A most useful duty has been found," he writes, "for a number of our motorcyclists in watching and following any man suspected of being one of the numerous spies which the Germans main tain behind our lines. These generally work in British and French uniforms and they almost invariably get about on motorcycles, as not only can they thus cover more ground, but they are much less likely to run against inconvenient questioners. One, dressed as a British officer, was brought into the station at Compiègn while I was there. He had been collared by one of our own wheelmen in a rather curious way.

"For two or three days this m cycling spy had been persistently shad-owed by the Britisher, who at last, finding his quarry compelled to dismount, ac sted him with a query as to his duties. The man, who spoke perfect English laughed pleasantly and said he was on staff work. Our cyclist asked if he had any papers to show, adding that he himself was on police work. The stranger vas quite willing to oblige and produced from his pocket some papers. 'That will show you who I am,' he remarked casually, displaying a couple of private letters directed to a Captain of the - Regiment.

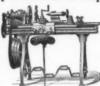
" 'That's done you,' retorted the Britisher, covering the man with his revolver.



"STAR" Foot and Powe Screw Cuttin Automatic LATHES For Fine, Accurate Work

SENECA FALLS MFG. CO. 695 Water Street neca Falls, N. Y., U. S. A.

For Gunsmiths, Tool Makers, Experimental & Repair Work, etc.



From 9-in. to 18-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.

W. F. & J. Barnes Co. 1999 Ruby Street Rockford, Ill.



The up-to-the-minute Holder—with six points and a "shock absorber." Worth Send for circular. knowing about

MONTGOMERY & CO., Tool Mongers 05-107 Fulton Street New York City 105-107 Fulton Street

The Elkins Saw Filer and Clamp





LET THIS "RED DEVIL" **CUT YOUR CIRCLES**

SMITH & HEMENWAY CO., Inc., 155 Chambers St., New York City

You May Crowd a CRESCENT JOINER



THE CRESCENT MACHINE CO., 230 Main St., Leet SPECIAL MACHINERY

CONTRACT MANUFACTURING
Have your work done by a big successful shep
places, STAMPINGS, DRAWINGS, ETC.
THE GLOBE MACHINE & STPG. CO., Cleveland

INVENTORS ment; lowest prices. Send perfect sample FREE for low estimate and best expert advice THE EAGLE MFG. CO., Dept. A. Cincinnati, O.



RUBBER Expert Manufacturers PARKER, STEARNS & CO.,

286-300 Sheffield Ave., Brooklyn, N. Y.

MODEL MAKING

LUX CLOCK CO., Inc., Waterbury, Cont



MACHINES Corliss Engines, Brewers and Bottlers' Machinery

The VILTER MFG. CO.

899 Clinton Street,

Milwaukee, Wis.



MECHANICAL SUPPLIES AND MATERIAL of all kinds
experimental and
LIGHT MACHINE WORK
to order
132 MILK STREET, ROSTON

WORKING MODELS

It just happens that the man whose let can jump over, if trees are on the road:

too fast, too sudden, and too often to have chines just behind a curve, and they were regular headquarters, so far as his forced to dismount and fight from b ne has defrected a missed for the fine being, he sets out to shot, when the third one thought of a loud find somewhere to wash, something to eat, some place to sleep, and last, but not least, gasoline." He has no speed limits to worry over, but the disastrous consequences of running at high speed into the their horses and disappeared. rear of a dark motor truck serve to keep his eyes straining and his ears alert, feet on the brake pedals, ready for instant

One of the greatest troubles of the mo toreycle rider in war-ridden France and Belgium is the necessity of riding without a lamp at night. The explosions of the motor are loud enough to cover the they are needed. call "Halt" of a sentry, and it is related that several motorcyclists were shot to death and a great many fired at by their own sentries because of their inability to battle line. hear the "Halt" signal. On one occasion a rider just managed to stop his machine in time to get the point of a French bay-onet to within a couple of inches of his have been dead

Plans are under way at present, based the experiences of the first four months of the war, to substitute a system of light signals at night for sentries. Flashlight lamps have been tried out, as well as the style red light, from which a covering cloth is drawn at the proper moment.

Dispatch riders tell with gusto of their growing ability in dodging flying shells coming toward them. The large shells, in particular, can be clearly "seen" at night and quite a few of the riders succeeded in evading death by swerving around the descending shells. On one occasion a big shell struck about fifty yards ahead of two motorcyclists coming at top speed and the hole torn into the roadway was so big that the machines could not avoid it. Both went headlong into the crater and were severely injured.

Still more interesting and dangerous is the lot of the motorcycle dispatch riders are taking part in the East African One of them, in a letter to his folk in England, tells the following in-teresting story: "The other night, when it just getting dark, the captain had to send me to the next camp, twenty-three miles away, and there is only one track running right through jungle all the way. Off I went on the most exciting ride I have ever undertaken. I was fully armed with a service rifle and revolver, hunting knife, water bottle, haversack, and ammunition. nunition. The first thing I ran into was pack of baboons, some of them nearly five feet high. They were terribly excited and ran in front of the machine in the full light for about a mile. The brutes simply wouldn't shift. You ought to have heard them bark. I would not have gotten into their clutches for all the money in the world. However, they at last turned into

"I also saw two fine leopards. One brute did not attempt to move until I was within three yards of him. I suppose he finally thought it wiser to get out of the path of the glaring light and the roar of the engine. He jumped snarling to one side and-maybe I didn't go when I got passed him! He might have taken it into ead to follow me!"

While leopards and baboons do not bother the motorcyclist in the European field of war, he has his hands full with problems which somehow or other never eem to have been thought out before. For instance, it has been found that where a instance, it has been found that where a cavalry patrol of small size is chased by motorcyclists, all the former need do is drag a telegraph pole or tree across the road—there are hundreds of fallen trees everywhere along the roads! The horses

*Extract from a letter which appeared in the British trade paper, The Autocycle, in the last week of October.

you've got is a particular friend of the motorcycles are detained long enough to allow the horsemen to escape. In one Another British rider who was with the expeditionary forces of Great Britain says the life is none too easy. "The motor-cyclist has to shift for himself; he moves the life is none too easy. The motor-cyclist has to shift for himself; he moves the road stopped the maany regular neadquarters.

After the tree. Several Uhlans were killed and he has delivered a dispatch and is diswounded and two of the cyclists also were took the Uhlans by surprise, they evidently believing it a call for assistance from some nearby force. They wheeled

Motorcycles have been used in the field operations for the following work:

1. Carrying orders to the motor truck

- and to cavalry commanders
- 2. Guiding motor trucks to their desti-
- 3. Calling ambulances and reinforce ents, guiding them to the places where
- 4. Assisting in dragging machine guns and gun sections
- 5. Police work on the roads behind the
- 6. Reconnoitering, which was formerly ecomplished exclusively by cavalry.
- 7. Acting as scouts in advance of long convoys of automobiles, seeing that the chest Less powerful brakes and he would roads are safe for traffic and free of ob-

The Good Roads Movement

THAT remarkable progress has been made in the building of good roads throughout the United States during the past few years is proven by data recently obtained by the American Highway Asso-ciation and soon to be published in the official Good Roads Year Book for 1915. It has been found that more than 34,000 miles of surfaced roads have been con structed during 1913 and 1914, and that during the ten-year period from 1904 to 1914 more than 96,000 miles have been completed. That this progress has been really amazing may be understood from the fact that in 1904 there were only 153,000 miles of surfaced roads of all types in the United States. That the movement is attaining momentum goes is proven by the fact that while the average mileage constructed per annum during the past ten years is 9,600 miles, total completed for 1914 exceeded 18,000 miles. The report will show that something like 30,000 miles of highway have been completed with the aid of State funds, of which over \$200,000,000 have been expended. The State aid movement began in 1892 and has therefore continued for twenty-two years. Only recently has it gotten well under way, as the results accomplished for 1913 and 1914 comprise a total of 10,000 miles of State aid high-ways completed, or in two years' time ne third of the entire mileage constructed with the aid of State funds has been com pleted.

Only six States now, out of a total of forty-eight, are without State highway departments, and thirty States have granted actual money aid to the building of roads The Year Book, which is the official reference publication for all good roads information, is a large cloth bound volume issued early in each calendar year by the American Highway Association

Aggregation and Anticipation.-In the recent case of Read Machinery Company v. Jaburg et al., Circuit Judge Hunt, in the decision, takes occasion to say with regard to aggregation and anticipation, as follows "Aggregation, as I understand it, will not apply where there is a combination of eleents capable of co-acting to produce a unitary result, provided such co-action produces novel and improved results which are useful," and that "Upon the contention that there has been anticipation it is nec ary, as I understand it, that the defendant shall show that all of the elements of the plaintiff's patent or the mechanical equiva-lents are found in the same description or machine where they do substantially the same work by substantially the same

Compac Auto Touring Tent



HO, TOURIST! Buy a Compac Auto Touring Tent and live in the open—Save Hotel Bills—Two Private Rooms—Separate Entrances—Sewed in Floor Cloth—Tent and Bed Combined—No Cots Necessary—Perfectly Ventilated—Speedily and Easily Erected or Taken Down—No Poles Required—Rolls up 7x20 inches—Waterproof—Bug Proof—Snake Proof.



Sportsman's Hiking Tent

Sewed in Floor Cloth.

Weight, 3¾ lbs. Erected, 6x8 feet. Rolls 4x16 inches

For leaky Auto Tops use Raintite Waterproofing Liquid and Com-Will not injure the finest fabrics. Applied easily with brush

FREE ILLUSTRATED CATALOGU

COMPAC TENT CO., Inc., 420 West Tenth St., Indianapolis, Ind. \$aaaaaaaaaaaaaaaaaaaaaaaaa

If yours is a one-man office or a 300-stenographer concern-

THE YALE & TOWNE MFG. CO.

The Dictaphone

The Dictaphone,
Dear Sirs:—

The seventy-five Dictaphones now used in handling our New York correspondence were installed after fourteen years' experience with dictation machines. We early recognized the dictation machine system as logical and inevitable as it eliminated the duplication of work—twice written letters—which shorthand necessitated.

In 1913 we investigated the relative merits of dictation machines from all angles, as we desired to standardize on one make. The order you received for seventy-five Dictaphones was the result.

Dictaphones in our offices have meant a large saving in the cost of our correspondence. If we should give up the use of the Dictaphone today, we would undoubtedly need a much larger number of stenographers.

In addition to this direct traceable saving, we feel that the convenience of the Dictaphone and the time and trouble it saves to those dictating correspondence, while difficult to estimate in dollars and cents, is of equal importance.

Your service has been uniformly prompt,

Yours very truly, THE YALE & TOWNE MFG. CO.



JOHN B. REIMER racite and Bituminous Coal Masons' Building Materials

OZONE PARK, New York,

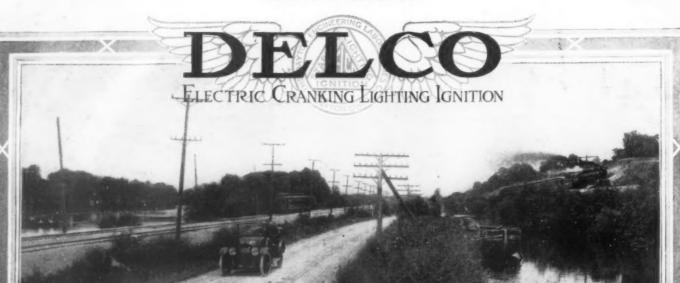
OZONE PARK, New York.

Answering yours of May 28th.
Asking a man who has once used the Dictaphone as to his opinion in regard to its practicability and efficiency, is like asking a man's opinion of the telephone, the electric light; trolley-cars as against horse-cars; railroadsasagainst stages; long-hand writing as against stenography, etc. The answer to these questions is so self-evident that any further expression of opinion is superfluous.

Yours very truly, ed) JOHN B. REIMER

TAE DICTAPADNE





The canoe, the canal boat, the railroad train, the interurban and the Delco equipped automobile—Epoch making steps in the development of transportation—all caught at the same instant by the eve of the camera

HROUGHOUT the history of the world civilization has hung closely upon the heels of transportation—

First there was the narrow trail through the woods and along the mountain side—the trunk of a tree across the stream—

Mankind walked and beast of burden carried-

Travel was slow and very circumscribed-

The world lived in a myriad of little communities, each separated from the other by the barrier of distance—

Then came boats—slow, cumbersome affairs—propelled by oar or sail or by mules along the canal routes—The world was brought a little closer together—a very little—

One day a boiling tea kettle suggested to an alert boy the latent power of steam—

The steam engine came-

A new era in transportation and in civilization dawned—

Railroads and steamships multiplied—they connected cities and nations—they developed agriculture and mining and industrial resources—they brought the world close together into one great intimately connected community—

Then came the electric car—the interurban—supplementing and still further developing the civilizing influence of railroad and steamship lines—

And finally came the automobile—crude at first, but quickly developing into a vehicle of almost unlimited speed and power—of universal adaptation and of marvelous grace and beauty.

The most popular of all means of transportation, the automobile has become the center of an enormous industry—it has revolutionized manufacturing and commercial methods—It has wonderfully developed

agriculture by bringing the farm and the city close together—it has renewed the interest in road making—one of the original influences for better civilization—it has largely increased the world's wealth and the world's pleasure—

And yet in spite of all this remarkable development the automobile was, until a very few years ago, sadly hampered by crude methods of starting and lighting—

Then came the Delco system—starting, lighting, ignition—electricity adding the one final touch to the efficiency of the gas driven car—

In a few short months the automobile industry was revolutionized—

The motor car that hitherto had required skill and a strong right arm to operate became as safe and simple and easy to control as an electric carriage—

The scope of its usefulness was greatly broadened—

The safety and pleasure of driving were intensified—

Today 190,000 Delco Equipped cars are in operation—

Thousands of them are being driven easily and safely by women—

You will find the Delco System at the Automobile Shows as regular equipment on the

Cadillac Buick Oakland Hudson Oldsmobile Stevens-Duryea Cole Moon Auburn Cartercar Jackson Westcott



These three units comprise the entire Delco System—cranking, lighting and ignition





erland FIAT

American KISSELKAR Ruchise



BAKER Œ **ELECTRICS**













WELD MCTS









You Should Know Every Part of the Car You Buy

THE CAR you buy will be equipped with Stanweld Rims, when you learn these facts. Stanweld Rims are made by America's They are made of the best material obtainable for the purpose. They are made by the most expert workmen employed in the rim-making industry. Every Stanweld Rim is tested four times—for quality of material; for accuracy; for ease and certainty of operation; and for the tire-fit by the Tire Manufacturers Association.

This company was the first to use electric welding in a practical and successful manner. And in the years that we have been engaged in the manufacture of rims, tubing, and parts by that method, we have perfected the process up to a point where today it is recognized as one of the greatest inventions of the last two

We are probably the only concern that ever has been called upon by the U.S. Government

to make test material by the electric welding method.

These facts should mean this much to you: That Stanweld Rims are first of all safe rims—the safest rims made. And because you want first of all a safe car, you should insist on a car equipped with Stanweld Rims.

Literature on any or all types of Stanweld Rims will be gladly sent to anyone free of charge. A post-card is sufficient.

STANWELD SEAMLESS TUBING

If you've ever owned a bicycle, motorcycle, or automobile, you've undoubtedly owned a piece of Stanweld Steel Tubing. It is used by the world's largest manufacturer of automobiles; by the world's largest manufacturer of motorcycles; and likewise by the world's largest maker of bicycles.

ing is used by so many manufacturers because it has a combination of qualities rare even to good steel tubing-light-ness, strength and fine finishing-qualities.

A large part of our tubing-output is sold in formed parts, the department for this work being the largest of its kind in the United

MODEL K

tubing is rapidly widen-ing. In many cases ing. In many cases it is replacing wood, fibre, copper, brass,

better appearance, and lower cost.

Although we have many large accounts we are always desirous of

Stanweld Steel Tubg is used by so many upwards of five million anufacturers because base a combination

The field for steel

and expensive machined parts, giving the finished articles greater strength, better appearance, and use steel tubing or tube parts.

We are able to offer a service which is ex-ceptionally valuable because of our experience with countless difficult and intricate problems.

Correspondence is invited on any matter ap-pertaining to steel tubing.

Stevens







OHIOELECTRICS

STANLEY



RICHMOND



The Standard Welding Co. Pioneers and World's Largest Producers of Rims for Motor-Driven Vehicles

Main Office and Factory

Distributors in Principal Cities CLEVELAND

perless

CUNNINGHAM

Lyons-Knight

BUFFALO ELECTRIC

HUDSON



The All-American Car



AS PIONEERS we once accepted European standards under the natural assumption that, being older in practice, they represented a more mature development.

But while our foreign connections were making parts that were acceptable as separate units, Packard engineers were working constantly toward their ideal of a completed car with every part designed and built in perfect harmony with every other part.

In the fixed purpose of attaining a Packard motor carriage standard which would surpass every previous achievement at home or abroad, we found the American answer for American requirements.

Results are valued in proportion to the intelligent and useful effort necessary to their accomplishment. Today the Packard is completely independent of Europe. It is Packardmade throughout and is rightfully acknowledged to be the criterion of motor cars.

Ask
the man who
owns one

PACKARD MOTOR CAR COMPANY
DETROIT MICHIGAN